IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF DELAWARE

TECHNOLOGY LICENSING CORPORATION, a Florida corporation, Plaintiff, v. RATIONAL COOKING SYSTEMS, INC., a Delaware corporation, Defendant.	C.A. No. 06-515-JJF

DECLARATION OF PORTER F. FLEMING, ESQ. IN SUPPORT OF DEFENDANT RATIONAL COOKING SYSTEMS, INC.'S ANSWERING BRIEF IN OPPOSITION TO TLC'S MOTION FOR ENTRY OF A PROTECTIVE ORDER

VOLUME I

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Attorneys for Defendant Rational Cooking Systems, Inc.

Dated: February 21, 2007

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

TECHNOLOGY LICENSING CORPORATION, Plaintiff, V. RATIONAL COOKING SYSTEMS, INC., Defendant.	Civil Action No. 06-515-JJF

DECLARATION OF PORTER F. FLEMING, ESQ.
IN SUPPORT OF DEFENDANT RATIONAL COOKING SYSTEMS, INC.'S ANSWERING BRIEF IN OPPOSITION TO TLC'S MOTION FOR ENTRY OF A PROTECTIVE ORDER

I, Porter F. Fleming, declare pursuant to 28 U.S.C. § 1746 that:

1. I am a partner with the law firm of Frommer Lawrence & Haug LLP located at 745 Fifth Avenue, New York, New York 10151 and am counsel to Rational Cooking Systems, Inc. ("RCSI") in this action.

2. I make the following declaration in support of RCSI's Answering Brief in opposition to Technology Licensing Corporation's ("TLC") motion for entry of a protective order (D.I. 46).

3. Exhibit A is a true and correct copy of a December 20, 2006 e-mail from Gregory E. Stuhlman, Esq. to the Court.

4. Exhibit B is a true and correct copy of an Electronic Notice of the SO ORDERED Mario Ceste application for admission *pro hac vice*.

5. Exhibit C is a true and correct copy of a January 4, 2007 letter from Frederick L. Cottrell, III to Jack B. Blumenfeld

6. Exhibit D is a true and correct copy of a January 5, 2007 letter from Porter F. Fleming to Rory J. Radding.

7. Exhibit E is a true and correct copy of a January 8, 2007 letter from Rory J. Radding to Porter F. Fleming.

8. Exhibit F is a true and correct copy of U.S. Patent No. 6,869,633.

9. Exhibit G is a true and correct copy of U.S. Patent App. No. 20050251450.

10. Exhibit H is a true and correct copy of U.S. Patent App. No. 20050193898.

11. Exhibit I is a true and correct copy of U.S. Patent App. No. 20050061160.

12. Exhibit J is a true and correct copy of U.S. Patent App. No. 20040020555.

13. Exhibit K is a true and correct copy of U.S. Patent App. No. 20040011006.

14. Exhibit L is a true and correct copy of U.S. Patent App. No. 20030207009.

15. Exhibit M is a true and correct copy of U.S. Patent App. No. 20030205034.

16. Exhibit N is a true and correct copy of U.S. Patent App. No. 20030205028.

17. Exhibit O is a true and correct copy of U.S. Patent App. No. 20030205027.

18. Exhibit P is a true and correct copy of Food Automation- Service Technique's ("FAST") Responses to the First Set of Interrogatories in *Food Automation-Service Techniques, Inc v United Electric Controls Co* , No. 95-12663.

19. Exhibit Q is a true and correct copy of TLC's Responses to the First Set of Interrogatories in *Technology Licensing Corp , et al v Turbochef Tech Inc* , No. 05-01245.

20. Exhibit R is a true and correct copy of Mario Ceste's biography on FAST's website printed on February 21, 2007.

21. Exhibit S is a true and correct copy of MINUTES of the public oral proceedings before the Technical Board of Appeal 3.2.4 of November 7, 1997.

22. Exhibit T is a true and correct copy of the Decision of the Technical Board of Appeal 3.2.4 of November 7, 1997.

23. Exhibit U is a true and correct copy of a November 12, 1997 FAST press release.

24. Exhibit V is a true and correct copy of the Settlement Agreement in *Food Automation-Service Techniques, Inc. v United Electric Controls Co* , No. 95-12663.

25. Exhibit W is a true and correct copy of the "Contact Us" page of FAST's website printed February 21, 2007.

26. Exhibit X is a true and correct copy of the "Contact Us" page of Smart Cooking Kitchen's® website printed on February 21, 2007.

27. Exhibit Y is a true and correct copy of FAST's Initial Disclosures in *Food Automation-Service Techniques, Inc. v. United Electric Controls Co.*, No. 95-12663.

28. Exhibit Z is a true and correct copy of TLC's Objections and Responses to RCSI's First Set of Interrogatories (Nos. 1-11).

29. Exhibit AA is a true and correct copy of TLC's Objections and Responses to RCSI's First Set of Requests for the Production of Documents and Things (Nos. 1-132).

I declare under penalty of perjury that the foregoing is true and correct.

Dated: February 21, 2007

Porter F. Fleming

CERTIFICATE OF SERVICE

I hereby certify that on February 21, 2007, I electronically filed the foregoing with the Clerk of Court using CM/ECF which will send notification of such filing(s) to the following and which has also been served as noted:

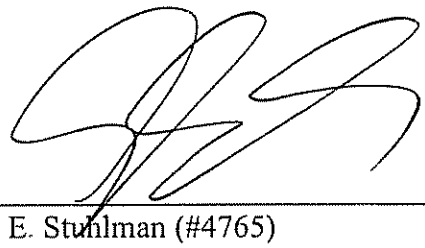
HAND DELIVERY

Jack B. Blumenfeld
Karen Jacobs Louden
Morris, Nichols, Arsht & Tunnell LLP
1201 N. Market Street
P. O. Box 1347
Wilmington, DE 19801

I further certify that on February 21, 2007, the foregoing document was sent to the following non-registered participants in the manner indicated:

FEDERAL EXPRESS

Rory J. Radding
Colette A. Reiner
Morrison & Foerster LLP
1290 Avenue of the Americas
New York, NY 10101-0050



Gregory E. Stuhlman (#4765)
Stuhlman@rlf.com

EXHIBIT A

From: Stuhlman, Gregory E
Sent: Wednesday, December 20, 2006 2:46 PM
To: 'jjf_civil@ded uscourts gov'
Cc: 'ehaug@flhlaw com'; 'pfleming@flhlaw com'; 'jblumenfeld@mnat com'; 'klouden@mnat com'; Cottrell, Frederick
Subject: Technology Licensing Corporation v Rational Cooking Systems, Inc , C A No 06-515-JJF - D I #23

Dear Judge Farnan.

This morning, counsel for Plaintiff Technology Licensing Corporation filed a motion (D I 23) for the *pro hac vice* admission of Mario Ceste (the "Motion") Defendant Rational Cooking Systems, Inc ("RCSI") plans to oppose Mr Ceste's *pro hac vice* admission in this case We respectfully request that Your Honor defer consideration of the Motion until RCSI is able to submit its opposition

Respectfully Submitted,
Gregory E Stuhlman
(#4765)

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One Rodney Square
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EXHIBIT B

From: ded_nefreply@ded.uscourts.gov
Sent: Wednesday, January 03, 2007 1:47 PM
To: ded_ecf@ded.uscourts.gov
Subject: Activity in Case 1:06-cv-00515-JJF Technology Licensing Corporation et al v. Rational Cooking Systems Inc. SO ORDERED

This is an automatic e-mail message generated by the CM/ECF system. Please DO NOT RESPOND to this e-mail because the mail box is unattended.
*****NOTE TO PUBLIC ACCESS USERS*** You may view the filed documents once without charge. To avoid later charges, download a copy of each document during this first viewing.**

U.S. District Court

District of Delaware

Notice of Electronic Filing

The following transaction was entered on 1/3/2007 at 1:46 PM EST and filed on 1/3/2007
Case Name: Technology Licensing Corporation et al v. Rational Cooking Systems Inc.
Case Number: 1:06-cv-515
Filer:
Document Number: No document attached

Docket Text:
SO ORDERED, re [23] MOTION for Pro Hac Vice Appearance of Attorney William J. Kuhne and Mario G. Ceste filed by Technology Licensing Corporation. Signed by Judge Joseph J. Farnan, Jr. on 1/3/2007. (dab)

1:06-cv-515 Notice has been electronically mailed to:
Jack B. Blumenfeld jbbefiling@mnat.com
Frederick L. Cottrell, III cottrell@rlf.com
Karen Jacobs Louden kjlefiling@mnat.com
Edgar H. Haug ehaug@flhlaw.com
Gregory Erich Stuhlman stuhlman@rlf.com
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Rory J. Radding rradding@mofo.com

:06-cv-515 Notice has been delivered by other means to:

EXHIBIT C

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DIRECTOR

DIRECT DIAL NUMBER
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January 4, 2007

VIA HAND DELIVERY

Jack B. Blumenfeld, Esquire
Morris Nichols Arsht & Tunnell
1201 North Market Street
P. O. Box 1347
Wilmington, DE 19899-1347

Re: *Technology Licensing Corporation v Rational Cooking Systems, Inc.*, C.A. 06-515-JJF

Dear Jack:

This letter concerns Mr. Mario Ceste and his involvement in this case. Yesterday, the Court "SO ORDERED" the *pro hac vice* admission of Mr. Ceste, notwithstanding an e-mail from us that we intended to file an opposition to that motion. We had planned to file the opposition this Friday, pursuant to the Local Rules

As you know, Mr. Ceste has been the subject of various correspondence between our respective co-counsel. My client opposes Mr. Ceste's involvement in the case for numerous reasons. In this regard, we would object to any Rational Cooking confidential documents being shown to Mr. Ceste pursuant to Local Rule 26.2. Moreover, it is my understanding that we have been pursuing a subpoena on Mr. Ceste so that we could receive documents and have informed your co-counsel that we wish to take his testimony on the issues of concern to Rational Cooking. Once this is accomplished, Rational Cooking will be in a better position to determine what, if any, further action it must seek from the Court, including withdrawal of the *pro hac vice* order, a motion to disqualify, or similar relief.

As to the subpoena, our understanding is that the process server believes that Mr. Ceste may be subject to service, but is not accepting it. Would you agree to accept service of the subpoena on him, produce the documents, and arrange for his deposition so that we may move to a conclusion of any issues surrounding his involvement in this case? Similarly, our process server has been attempting since December 14, 2006 to serve subpoenas on FAST, Bernard Koether and George Koether. It is my understanding that certain FAST employees will not let the process server on the FAST premises. Again, we would like to move this along. Will you agree to accept service of these subpoenas as well? Copies are enclosed with a revised return date of January 22, 2007.

Thank you.

Very truly yours,

Frederick L. Cottrell, III

Enclosures

FLC,III/afg

cc: Edgar H. Haug, Esquire (via e-mail)
Porter F. Fleming, Esquire (via e-mail)
Rory J. Radding, Esquire (via e-mail)
Gregory E. Stuhlman, Esquire

EXHIBIT D

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January 5, 2007

VIA FACSIMILE

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New York, NY 10101-0050

Re: Technology Licensing Corp. v. Rational Cooking Systems, Inc.
Civil Action No.: 1:06-cv-00515-JJF

Dear Rory:

I have received your January 4th e-mail and am compelled to respond to certain inaccuracies and unnecessary and unfounded allegations.

As you are well aware, we had discussed the deposition of Mario Ceste in December, agreed to specific language in the Rule 16 Scheduling Order and I wrote to you on December 20th requesting that you provide Ceste deposition dates in early January. You did not respond to my letter. Instead, I received correspondence from Bill Kuhne in what appeared to be a clear attempt to back-track from our earlier discussions. Mr. Kuhne, who was not part of those discussions, sought to impose new obligations/burdens on RCSI to demonstrate that a deposition was necessary. This makes no sense. In addition to delaying the deposition, the correspondence makes clear that Mr. Ceste does have relevant information and that Mr. Kuhne's main concern appears to be making sure that Mr. Ceste will only be deposed once in the case.

Likewise, I was surprised that you and Mr. Kuhne would not agree to accept service of the Ceste subpoena. Despite your recent statements to the contrary, neither you nor Mr. Kuhne has accepted service. Instead, Mr. Kuhne insisted on conditions before accepting service. These conditions were meaningful as your proposed return date would deliberately prevent us from having access to any Ceste materials prior to the date on which our opposition to the *pro hac vice* motion would have been due.

In what appears to be further gamesmanship, you were certainly aware that RCSI had an issue with Mr. Ceste having access to confidential documents in this case. On December 12th, we provided you with a revised version of the draft protective order that clearly stated in paragraphs 14 and 20 that Mr. Ceste would not have access to Confidential and Highly Confidential documents. Likewise, paragraphs 13(a) and 17(a) provided that only an outside attorney from

specifically named law firms would have access. Mr. Ceste was intentionally not identified. During discussions with you and Jack Blumenfeld on December 18th, we again discussed the Ceste issues. You stated that our proposed paragraphs 14 and 20 were unacceptable. Similarly, you also stated that the limitation to specific law firms as outside counsel in paragraphs 13(a) and 17(a) had to be deleted as well. Unable to reach agreement on the protective order, the very next day, December 19th, Mr. Ceste signed his certificate to be admitted and on December 20th a motion for *pro hac vice* was filed lends us to question the coincidental timing of your actions. As you know, Delaware Local Rule 26.2 provides that if no protective order is in place, trial counsel will have access to confidential documents. Clearly your plan was to have Mr. Ceste be trial counsel and have access to confidential documents despite our objections.

We informed you and the Court that we intended to oppose Mr. Ceste's application. It now appears that the motion has been "So Ordered" by the Court on January 3rd. As Mr. Ceste is now an officer of the Delaware Court for purposes of this case, I do not understand why he continues to refuse to accept service of the subpoena. Mr. Ceste has also on two occasions refused to respond to letters sent to him dated December 22nd and January 3rd. We are unaware of any reason why Mr. Ceste can not speak for himself. Further, neither you nor Mr. Kuhne has stated that you are representing Mr. Ceste. If you are, please so advise.

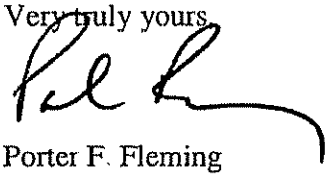
As I am sure you can appreciate, we believe that many relevant documents in this case regarding the patent are probably not in TLC's possession, as it did not even exist when any work was done by the inventors nor was TLC involved in the patent prosecution process. We believe that this clearly relevant and discoverable material is in the possession of FAST and/or the Koether's. We have been attempting to serve the three subpoenas attached to yesterday's letter to Jack Blumenfeld since mid-December. FAST employees have refused to accept service and most recently denied the process server access to the FAST facility. Appreciating that you were (and may still be) counsel to FAST when it was a co-plaintiff in the original complaint, we again request that you accept service of these three subpoenas. Should you refuse, we will have no choice but to continue to try to serve them and seek appropriate relief from the Court.

We continue to object to Mario Ceste's involvement in this case as an attorney for TLC with access to RCSI's confidential documents. Delaware Lawyers' Rules of Professional Conduct Rule 3.7 provides that "a lawyer shall not act as an advocate at trial in which the lawyer is likely to be a necessary witness." This situation applies to Mr. Ceste as he is likely to be a necessary witness. Further, combining the roles of advocate and witness will be prejudicial and a conflict of interest. Not only does Mr. Ceste have factual information regarding FAST, prior art, and prior dealings with Rational AG that will bear on the claims, counterclaims, and defenses in this case, he also appears to still be involved in the oven/control business. Your e-mail was silent regarding our request that Mr. Ceste not be shown any RCSI confidential information until this issue is resolved by the Court. We will agree to a January 22, 2007 return date for the Ceste

subpoena and look forward to you providing proposed deposition dates appreciating that we want to review the Ceste production prior to his deposition.

Finally, despite your request, the Federal Rules regarding subpoenas do not provide for *quid pro quo* requirements. Your correspondence to date implies that discovery is a continuous opportunity for *quid pro quo* demands. This is not how we intend to proceed. Unnecessary delay, deliberate and self-serving conditions and further attempts to avoid service need to end. We seek legitimate discovery and should not be forced to waste the Court's time and resources to get it. As for your request regarding Rational AG, we have already discussed that with you. We have yet to receive any focused discovery demands from you. Upon receipt, we will consider your attempt to avoid The Hague Convention procedures.

Very truly yours,



Porter F. Fleming

PFF:bf

cc: Frederick L. Cottrell, III, Esq.
Jack B. Blumenfeld, Esq.
Mario G. Ceste, Esq.

EXHIBIT E

MORRISON | FOERSTER

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January 8, 2007

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Via E-Mail & U.S. Mail

Porter F. Fleming, Esq.
Frommer Lawrence & Haug LLP
745 Fifth Avenue
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Re: Technology Licensing Corp. v. Rational Cooking Systems, Inc., Civ. No. 1:06-cv-00515-JJF

Dear Porter:

I refer to your January 5, 2007 letter.

First, we will accept service of the subpoena duces tecum on behalf of Mr. Ceste with a January 22, 2007 return date as proposed in your letter and subject to any objection that Mr. Ceste may have to the subpoena. We also agree not to provide to Mr. Ceste any confidential information produced by Rational or Rational A.G. until the parties or the Court resolve whether Mr. Ceste can receive such information. We would like to have this issue resolved as soon as possible so we propose that Mr. Ceste's deposition on the limited issue relating to confidentiality be taken on February 1 or 2. The issue of whether Mr. Ceste is a "necessary witness" is not appropriate at this time and can be deferred until after you can demonstrate that Mr. Ceste has unique knowledge not available through other means. Second, we will also accept service of the subpoenae duces tecum on FAST, Mr. Ben Koether and Mr. George Koether provided you agree to a return date of February 9, 2007 or later for these subpoenas.

I respectfully disagree with your characterization of the events in your January 5 letter concerning your discovery attempts. Your actions have lead to an unfortunate waste of time, effort and money in a letter writing campaign and needlessly harassed Messrs. Ceste, Koethers and FAST. The following sets the record straight.

1. **Mario Ceste**

   a. **Deposition**

Mr. Ceste, as you know, is co-counsel in this case. It is correct that we had discussed the taking of his deposition during our conversations in December 2006 in connection with the Rule 16 Scheduling Order. As a result, the language we both drafted, accepted and which was entered by the Court in the Rule 16 Scheduling Order clearly states that Rational has the "right to seek" to take the deposition of Mr. Ceste before the end of initial discovery. There was no agreement that a deposition was either necessary or assured. Also, your December 20 correspondence appeared to change the reasons you seek to take Mr. Ceste's deposition from a concern that he would somehow use Rational confidential information on TLC's or FAST's behalf (outside of the litigation) to his supposed status as a "fact witness" apparently in view of his prior employment by FAST. These are two different issues. Mr. Kuhne properly requested clarification of the basis for your need to depose Mr. Ceste since deposing Mr. Ceste as a fact witness is not necessary nor appropriate at this stage of the case and prior to completion of initial discovery, and was not what we discussed in agreeing that you could seek to take his deposition prior to the completion of initial discovery. Also, whether Mr. Ceste has knowledge of facts does not make him a "necessary witness" as there are others at FAST, TLC or other third parties who likely would have knowledge of the same facts. Thus, we did not , and do not, see any need for his fact deposition as a purported fact witness at this time.

In your January 5, 2007 letter you expand on what facts you believe Mr. Ceste "is likely to be a necessary witness" for — "factual information regarding FAST, prior art, and prior dealings with Rational AG." Your letter ignores the fact that others at FAST, TLC, Rational AG and possibly other third parties would have the same, if not more knowledge of these fact issues. Clearly, Mr. Ceste is not "a necessary witness " under the law and rules when his knowledge of the relevant facts can be obtained from other sources. Moreover, I can represent to you that Mr. Ceste is not still "involved in the oven/control business" other than his capacity as outside counsel. He is involved in the oven/control business as much as you are.

Also, during the December 18, 2006 discussion you refer to, we believe the parties agreed that the filing of the motion to admit Mr. Ceste *pro hac vice* would be the best route to tee up the confidentiality issue for decision by the Court. In fact, during that conference call, I believe Ed Haug asked how are we going to resolve the confidentiality issue about Mr. Ceste and Jack Blumenfeld responded that the issue could be raised when we file our *pro hac* motion. No one disagreed. It should have not come as any surprise to you that we acted quickly to file the motion so we could get this issue resolved as soon as possible. You, however, surprised us by raising an issue not addressed in any of our December discussions,

that is, you changed your position from concern about confidentiality to attempting to disqualify Mr. Ceste as counsel due to his supposed status as a fact witness.

b. Subpoena Duces Tecum

There has been no attempt to delay, no deliberate, self-serving conditions and certainly no attempt to avoid service concerning your subpoena for Mr. Ceste's documents. As previously explained in my e-mail dated January 4, 2007, Mr. Ceste never refused service and believed, correctly, that we were (and are) representing him. Thus, he had no need to respond to you and correctly advised the process server that his lawyers were taking care of service. See January 4, 2007 e-mail and prior letters dated December 28, 2006 and January 3, 2007. On the other hand, you have wasted everyone's time, money and effort and needlessly harassed a co-counsel. We thought it was clear that we, and specifically Mr. Kuhne, would be representing Mr. Ceste and, in view of the holiday period, we agreed to accept service of the subpoena, if you agreed to extend the return date to provide reasonable time for objection and response. Only in your January 5, 2007 letter did you offer the January 22, 2007 return date, which we accept. Also, for the record, we were surprised to learn that you previously had attempted service on Mr. Ceste in mid-December, 2006 without any prior notice to me or TLC's counsel in clear violation of Rule 45 of the Federal Rules of Civil Procedure.

2. FAST and Koethers

Concerning the subpoenas duces tecum on FAST and the Koethers, I was surprised to learn that you had been attempting to serve FAST and the Koethers in mid-December (and had served United Electric and TurboChef), again long before I received any prior notice from you in clear contravention of Rule 45 F.R.Civ.P. As explained in my e-mail dated January 4, 2007, to my knowledge FAST employees have never refused to accept service. To the contrary, I now have been informed that FAST employees said they would accept service, but they were told by the process server that he had to serve the Koethers personally. Also the process server was told that in view of the holidays, the Koethers were not available until after the new year. As noted above, we will accept service on FAST and the Koethers' behalf as long as the return date is February 9, 2007 or later.

3. Rational A.G.

Concerning Rational AG, we will send you our discovery requests tomorrow. We are not attempting to avoid The Hague Convention but rather attempting to avoid an unnecessary, time-consuming and costly discovery dispute.

Finally, it is ironic that in the same paragraph of your letter in which you pontificate that discovery is not a series of *quid pro quos*, you state that you will only consider our request

that you accept service of a subpoena on behalf of Rational AG if we negotiate the document requests to Rational AG with you. Suffice it to say, if you want our cooperation in this litigation, you will have to give some cooperation. Here, you have asked us to accept service voluntarily on behalf of FAST, Bernard Koether, and George Koether, and our request to you to accept service voluntarily on behalf of Rational AG is based on the reasonable view that if one party asks another to accept service voluntarily for an affiliated non-party the requesting party should be willing to act in a similar manner with respect to a similar request.

Yours truly,

Rory J. Radding

cc: William Kuhne, Esq.
Jack Blumenfeld, Esq.
Frederick Cottrell, III, Esq.
Mario Ceste, Esq.

EXHIBIT F

US006869633B2

(12) **United States Patent**
Sus et al.

(10) **Patent No.: US 6,869,633 B2**
(45) **Date of Patent: Mar. 22, 2005**

(54) **AUTOMATED FOOD FRYING DEVICE AND METHOD**

(75) Inventors: **Gerald A. Sus**, Frankfort, IL (US); **Ron Dorsten**, Oak Brook, IL (US); **Henry T. Ewald**, Roselle, IL (US); **Jenny Hong**, Palatine, IL (US); **Glenn Schuckmuth**, Montgomery, IL (US); **Mario G. Ceste**, Wallingford, CT (US); **Curtis Clarence Pinnow**, Libertyville, IL (US); **John M. Corliss**, Lynn, MA (US); **Joseph Gerstmann**, Framingham, MA (US); **James Lozouski**, Marlborough, MA (US); **William Day**, New Port Richey, FL (US); **Doug Jones**, New Port Richey, FL (US); **Roberto Nevarez**, Hudson, FL (US); **Jerry Sank**, Palm Harbor, FL (US); **Keith Stanger**, New Port Richey, FL (US)

(73) Assignee: **Restaurant Technology, Inc.**, Oakbrook, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U S C 154(b) by 47 days

(21) Appl No : **10/127,203**

(22) Filed: **Apr. 22, 2002**

(65) **Prior Publication Data**

US 2003/0207009 A1 Nov 6, 2003

(51) **Int. Cl.**[7] **A23L 1/01**; A47J 37/12

(52) **U.S. Cl.** **426/438**; 99/403; 99/407; 99/409; 426/439

(58) **Field of Search** 426/438, 439; 99/330, 403, 407, 409

(56) **References Cited**

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1,927,318 A 9/1933 McEntee

(List continued on next page)

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JP	52.2954	11/1977
WO	WO 86/07648	12/1986

OTHER PUBLICATIONS

Patent Cooperation Treaty, International Searching Authority, International Search Report, Aug 28, 2003, PCT/US03/12169

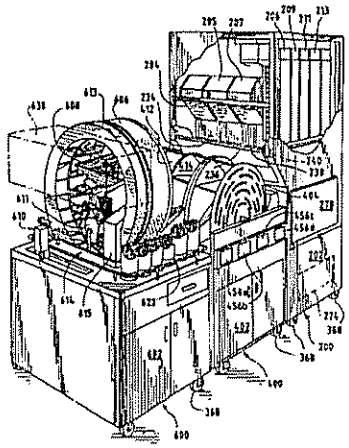
Primary Examiner—George C Yeung
(74) *Attorney, Agent, or Firm*—Ryndak & Suri

(57) **ABSTRACT**

An automated food processing system and method is provided that allows food to be dispensed, fried and packaged in a suitable container, which may be an individual portion-sized container In one embodiment, the system includes separate automated modules for dispensing, frying and packaging the food

In one embodiment, an automated dispensing device dispenses a predetermined portion of food from a bulk storage container or food dispensing magazine Food is dispensed from the automated dispensing device to an automated fry device that can include at least one circular fry wheel having a plurality of food containing compartments After the food is fried it is dispensed from the fry device to an automated packaging device The automated packaging device dispenses food to a container that may be an individual portion-sized container that is retrieved, erected and held into position for filling by an automated container handling system After a food container is filled, a conveyor system transports the filled container to a suitable pick-up location

14 Claims, 42 Drawing Sheets



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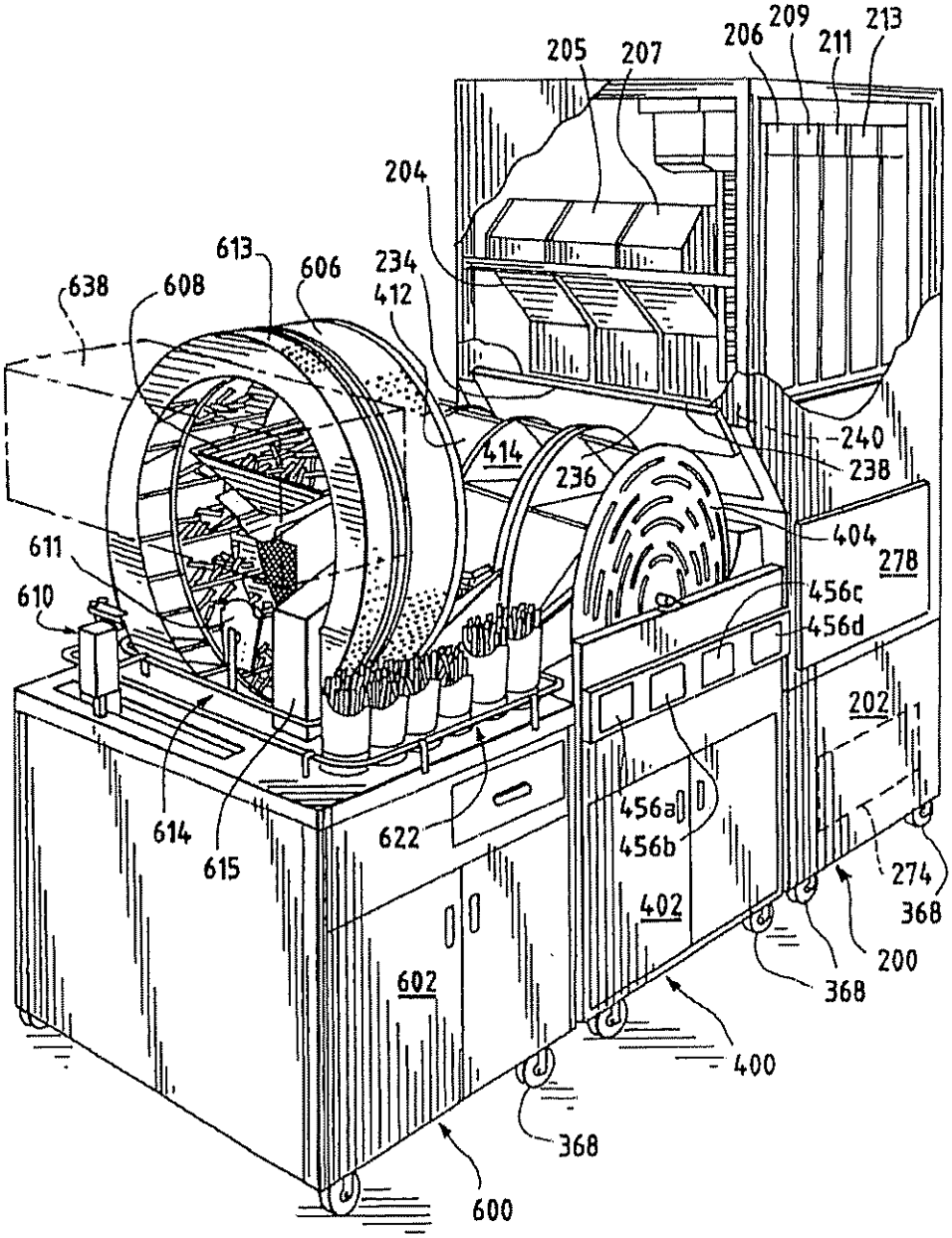
* cited by examiner

FIG. 1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207
206
209
211
213
204
613
606
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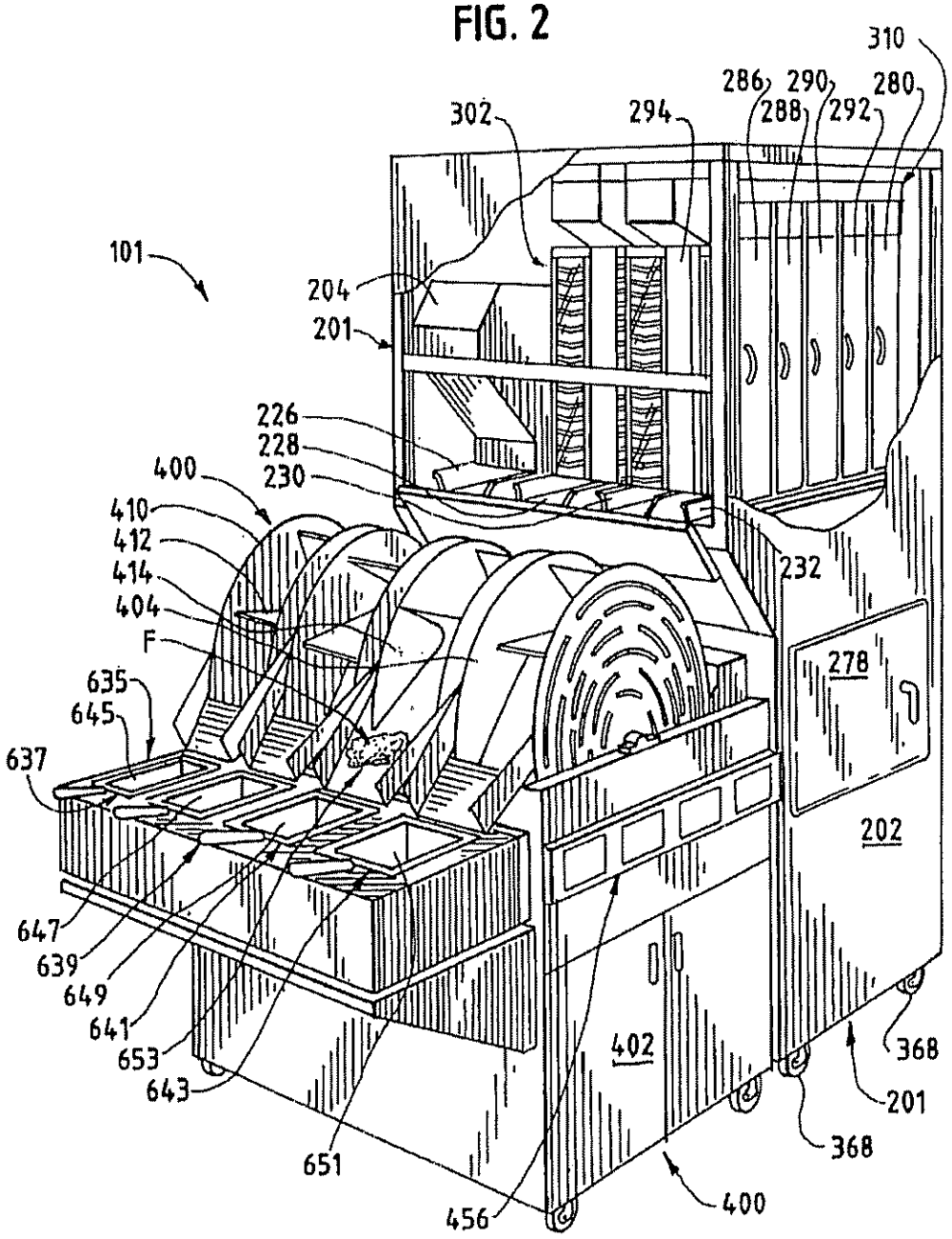
412
638
608
414
236
240
238
404
278
611
610
456c
456d
202
456a
456b
614
615
622
274
368
402
200
602
368
400
600

FIG. 2


310
286
290
280
288
292
302
294
101
204
201
226
228
230
400
410
412
414
404
F
232
278
635
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637
202
647
639
649
641
653
643
651
402
368
201
368
456
400

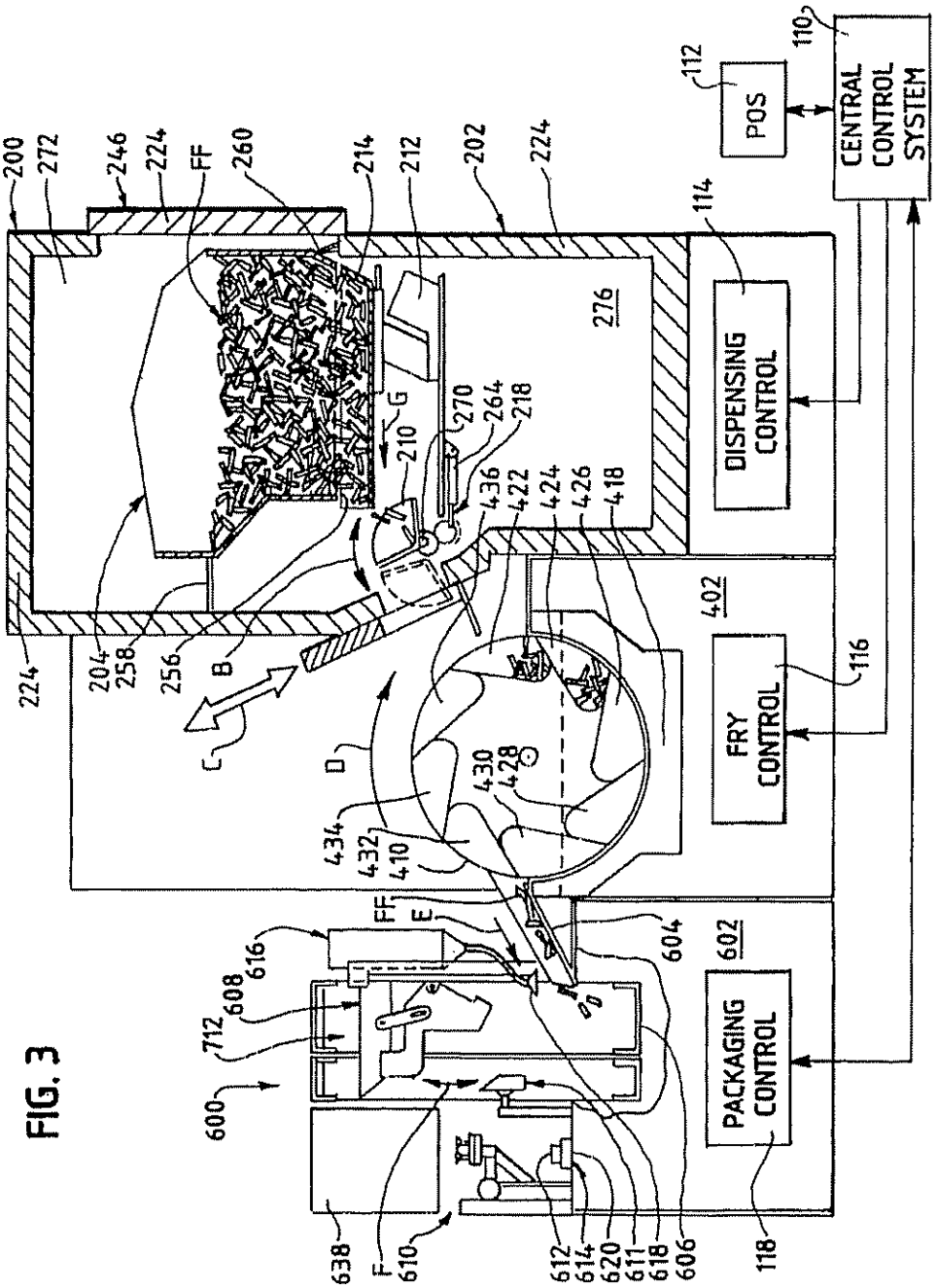

CENTRAL CONTROL SYSTEM
POS
DISPENSING CONTROL
FRY CONTROL
PACKAGING CONTROL
110
112
114
116
118
200
272
246
224
FF
260
214
212
202
276
210
G
270
264
218
436
422
424
426
418
402
204
258
256
B
C
D
430
428
434
432
410
E
604
602
616
608
712
600
638
F
610
612
614
620
611
618
606

FIG. 3

FIG. 4

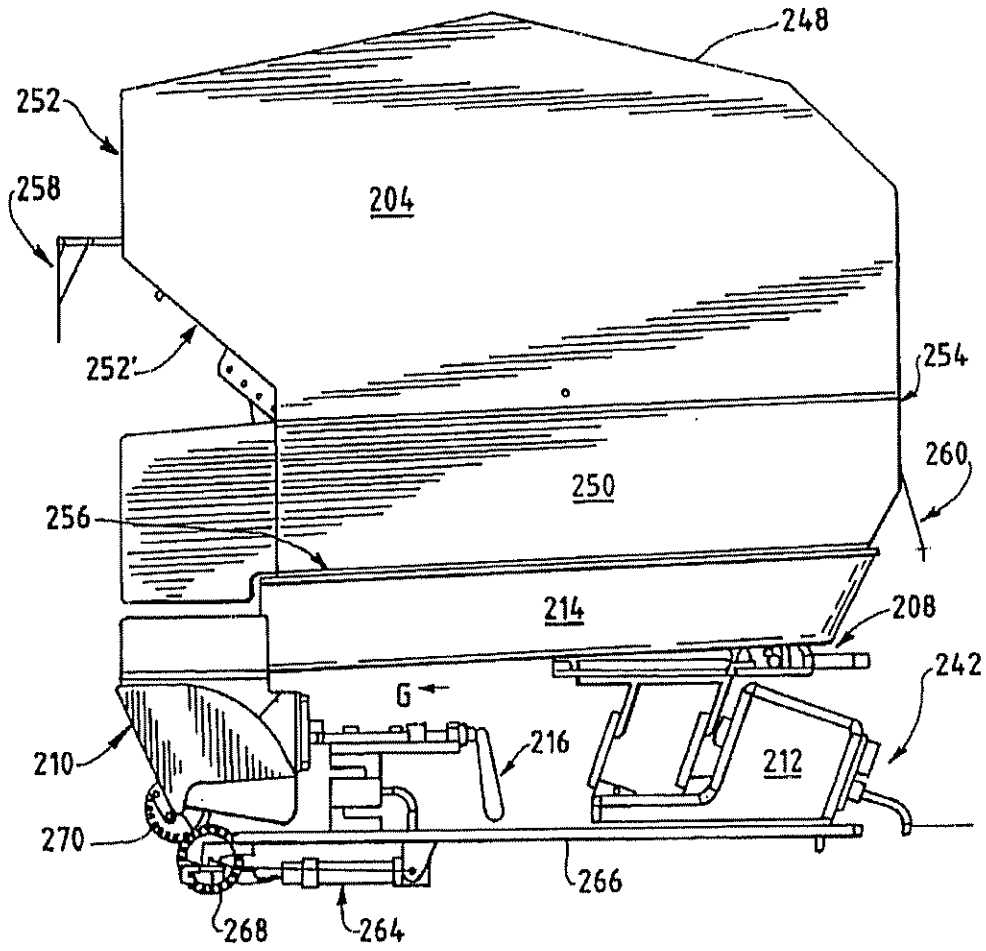

248
252
258
204
252'
254
260
250
256
214
208
242
G
216
210
212
270
266
268
264

FIG. 4A

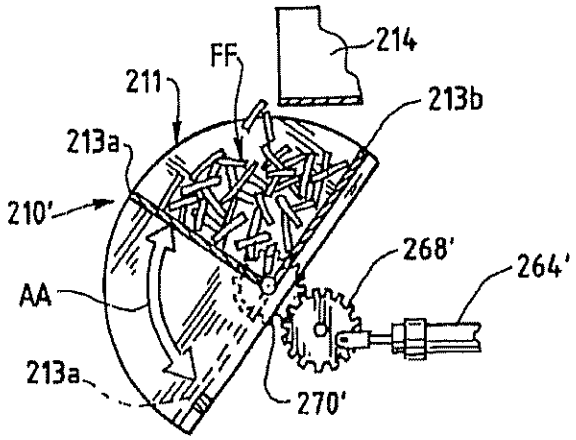

214
FF
211
213b
213a
210'
268'
264'
AA
213a
270'

FIG. 5

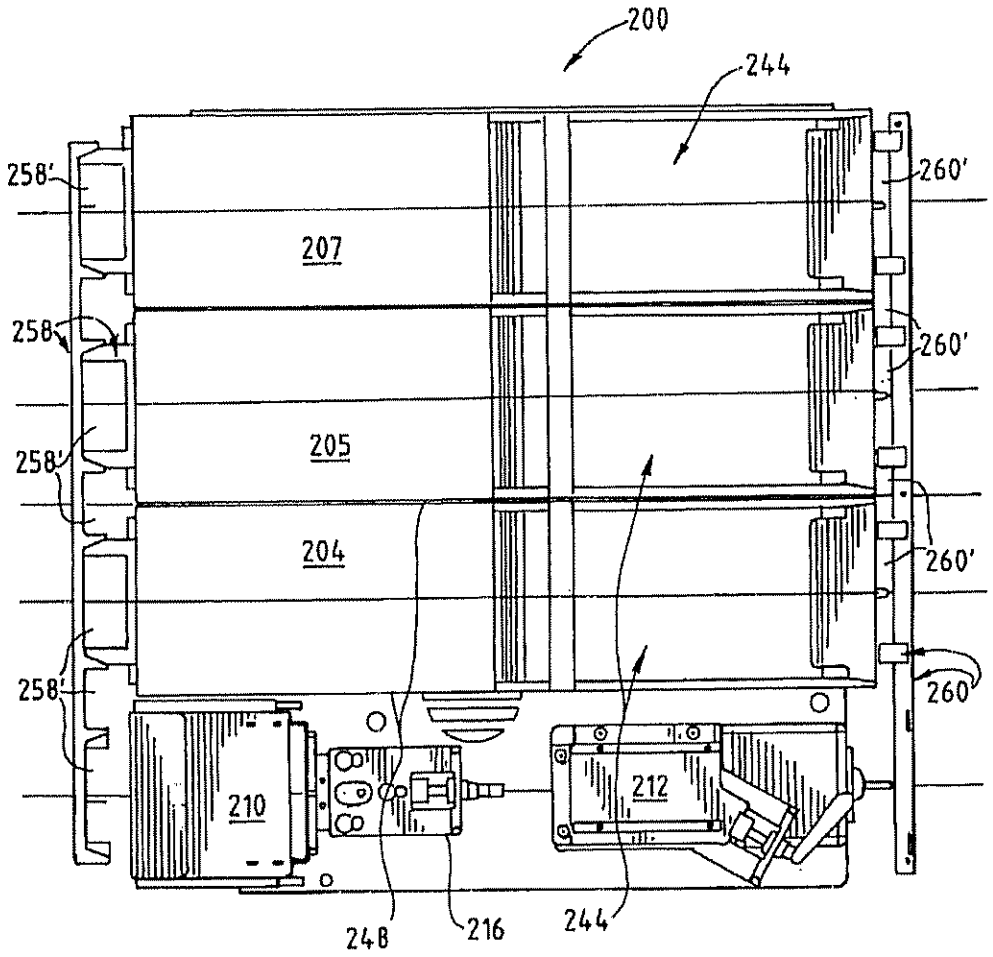

200
244
258'
260'
207
258
260'
205
258'
204
260'
258'
260
210
212
248
216
244

FIG. 6

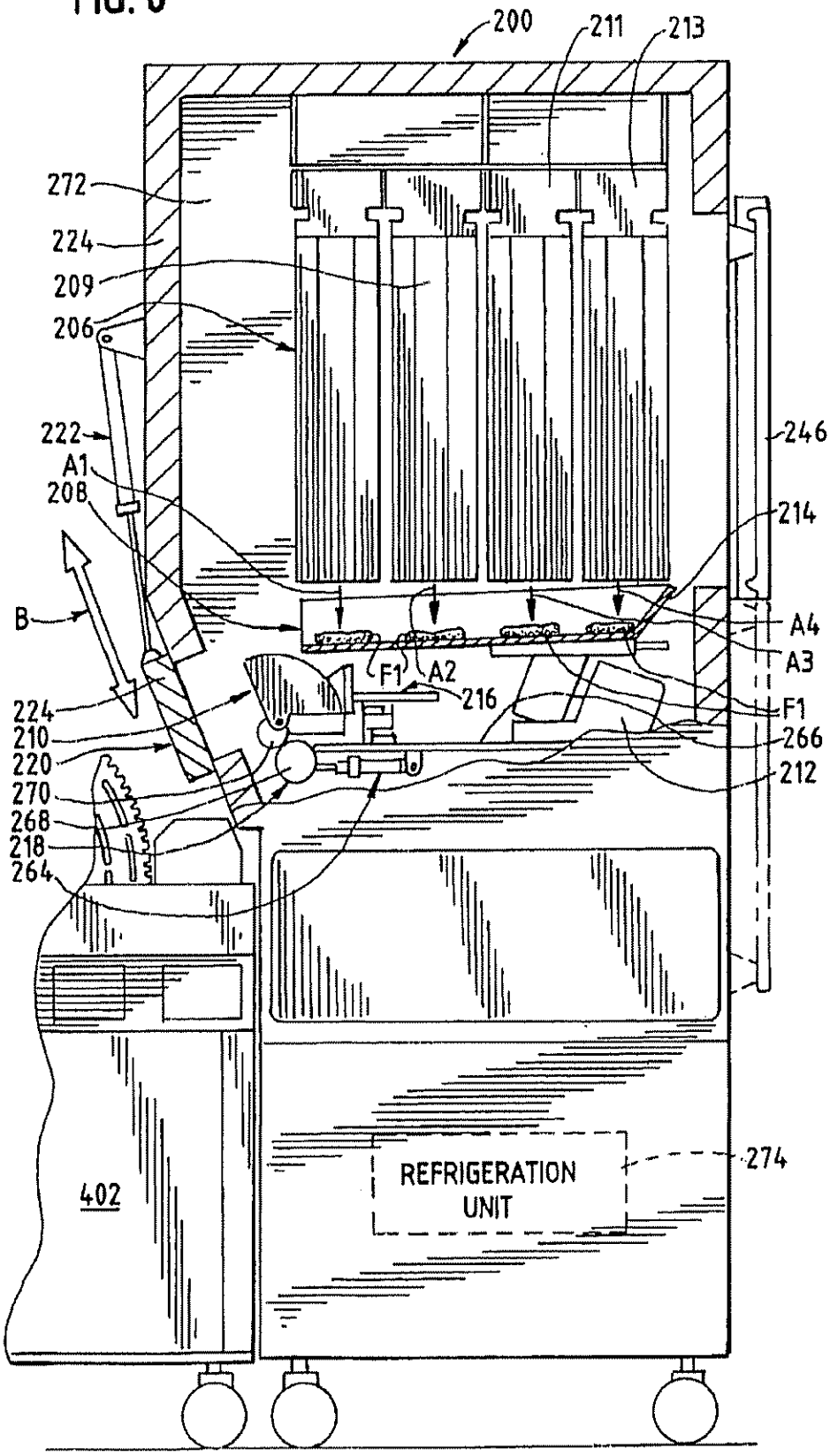

200
211
213
272
224
209
206
222
A1
208
B
224
210
220
270
268
218
264
246
214
A4
A3
F1
A2
216
F1
266
212
REFRIGERATION UNIT
274
402

FIG. 7

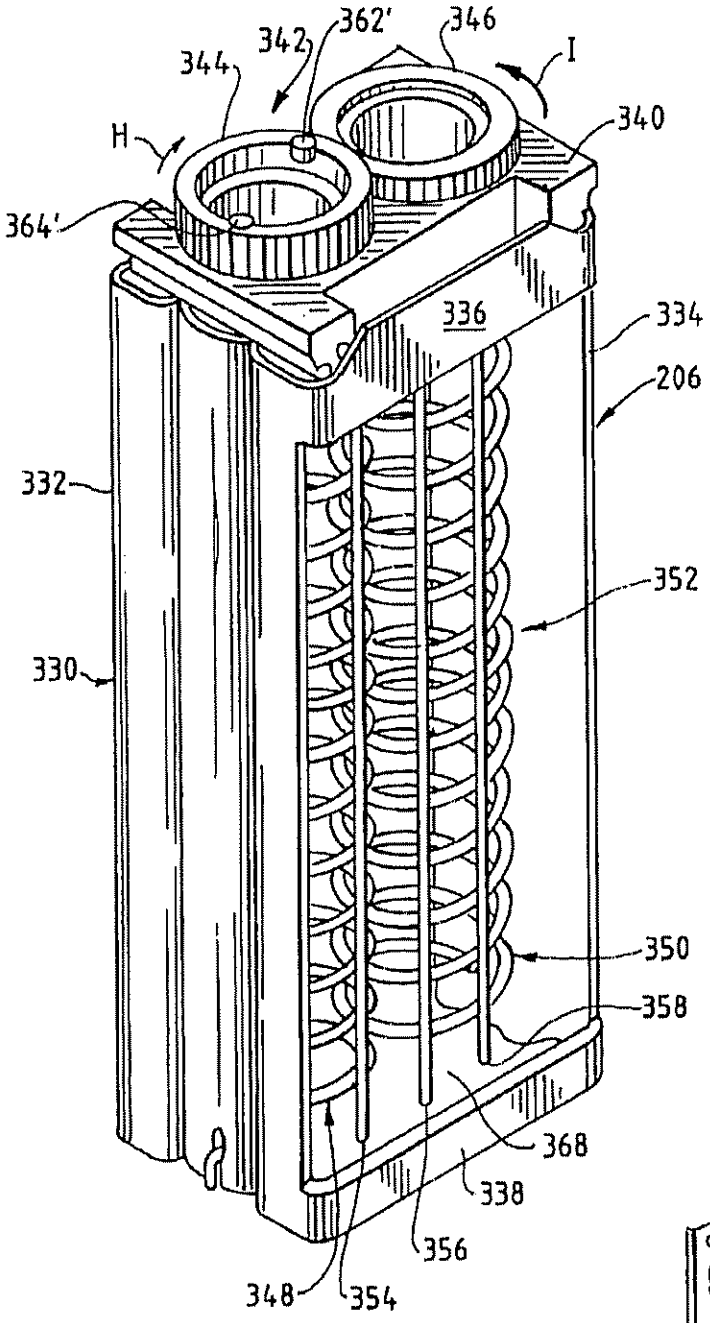

362'
346
342
344
I
H
340
364'
336
334
206
332
352
330
350
358
368
338
356
348
354

FIG. 8

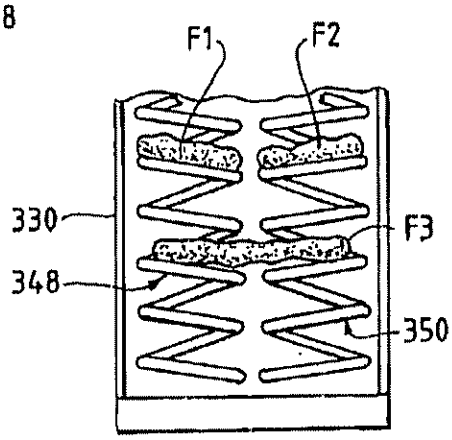
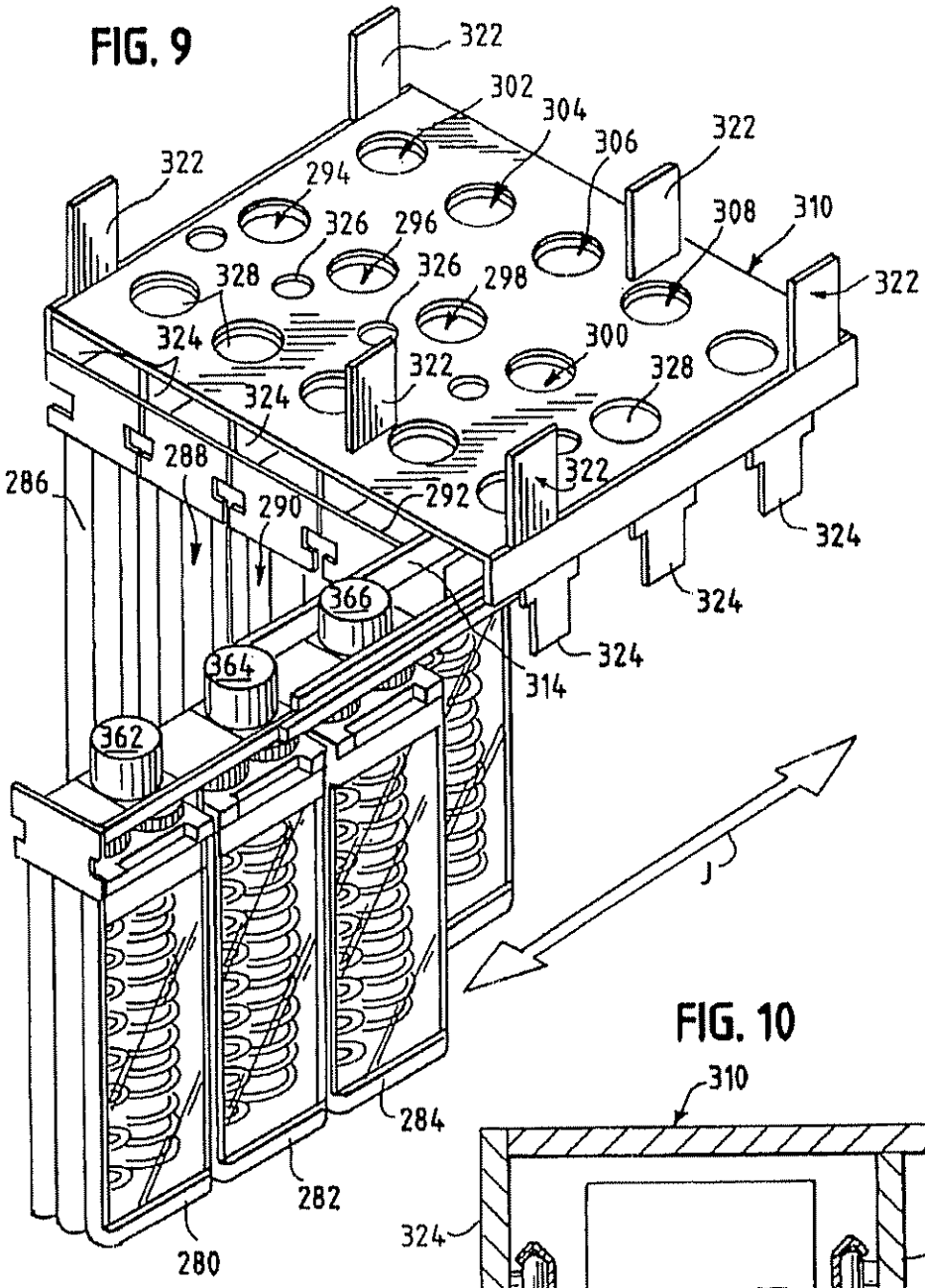

F1
F2
330
F3
348
350

FIG. 9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302
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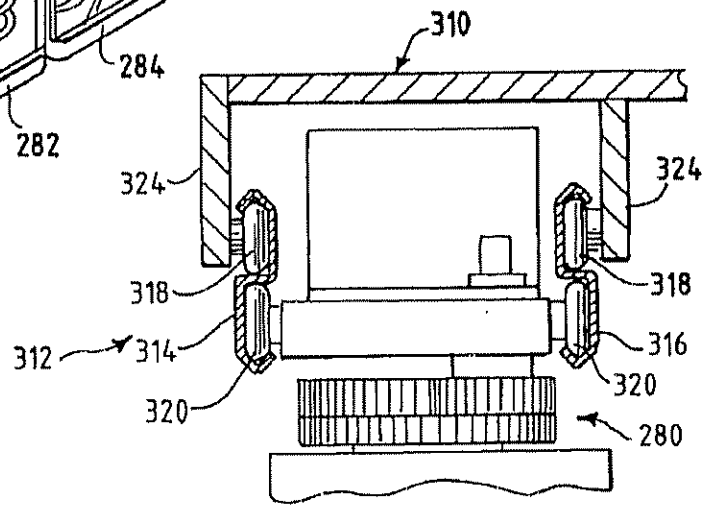
306
322
322
294
308
310
326
296
328
326
298
322
324
300
328
324
322
288
286
290
292
322
324
324
324
366
364
314
362
J
284
282
280

FIG. 10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324
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318
316
312
314
320
320
280

FIG. 11

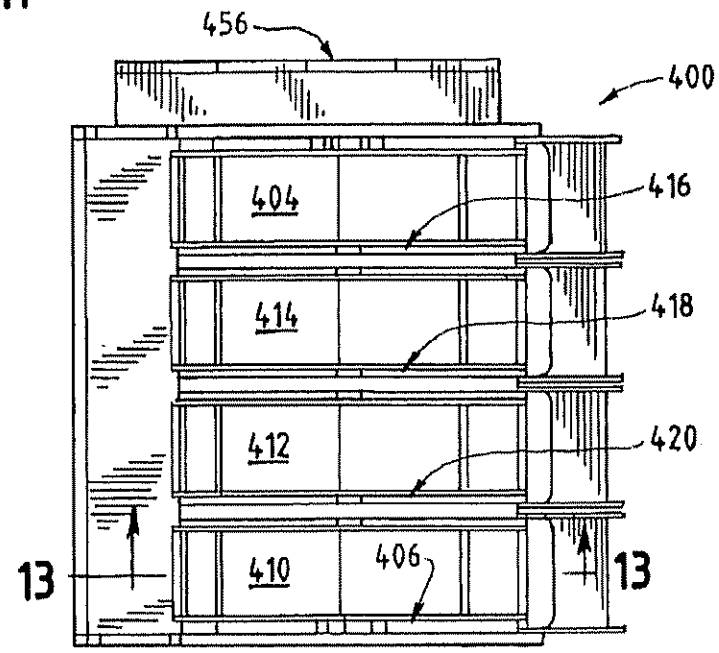
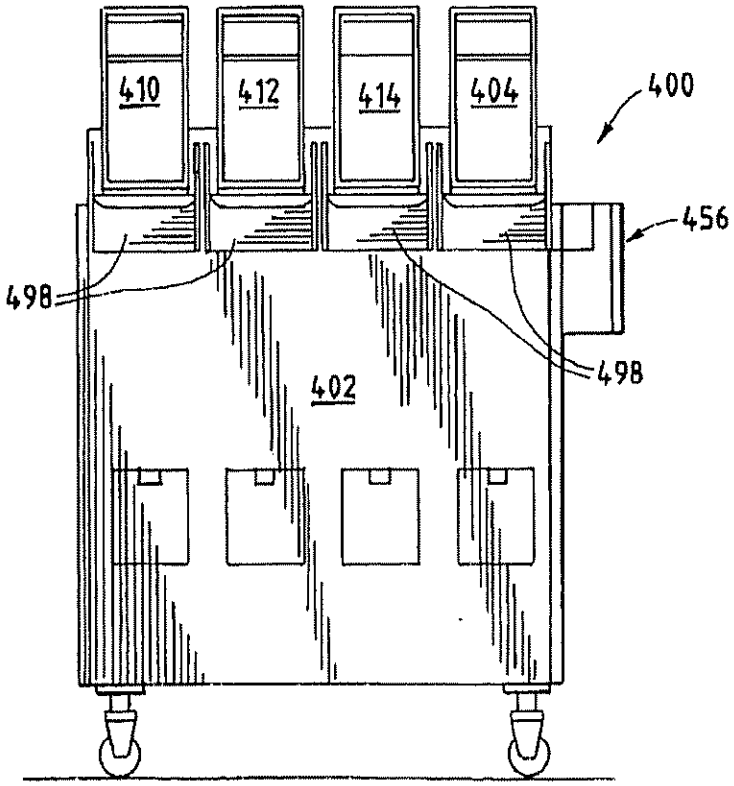

456
400
404
416
414
418
412
420
13
410
406
13

FIG. 12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412
414
404
400
456
498
498
402

FIG. 13

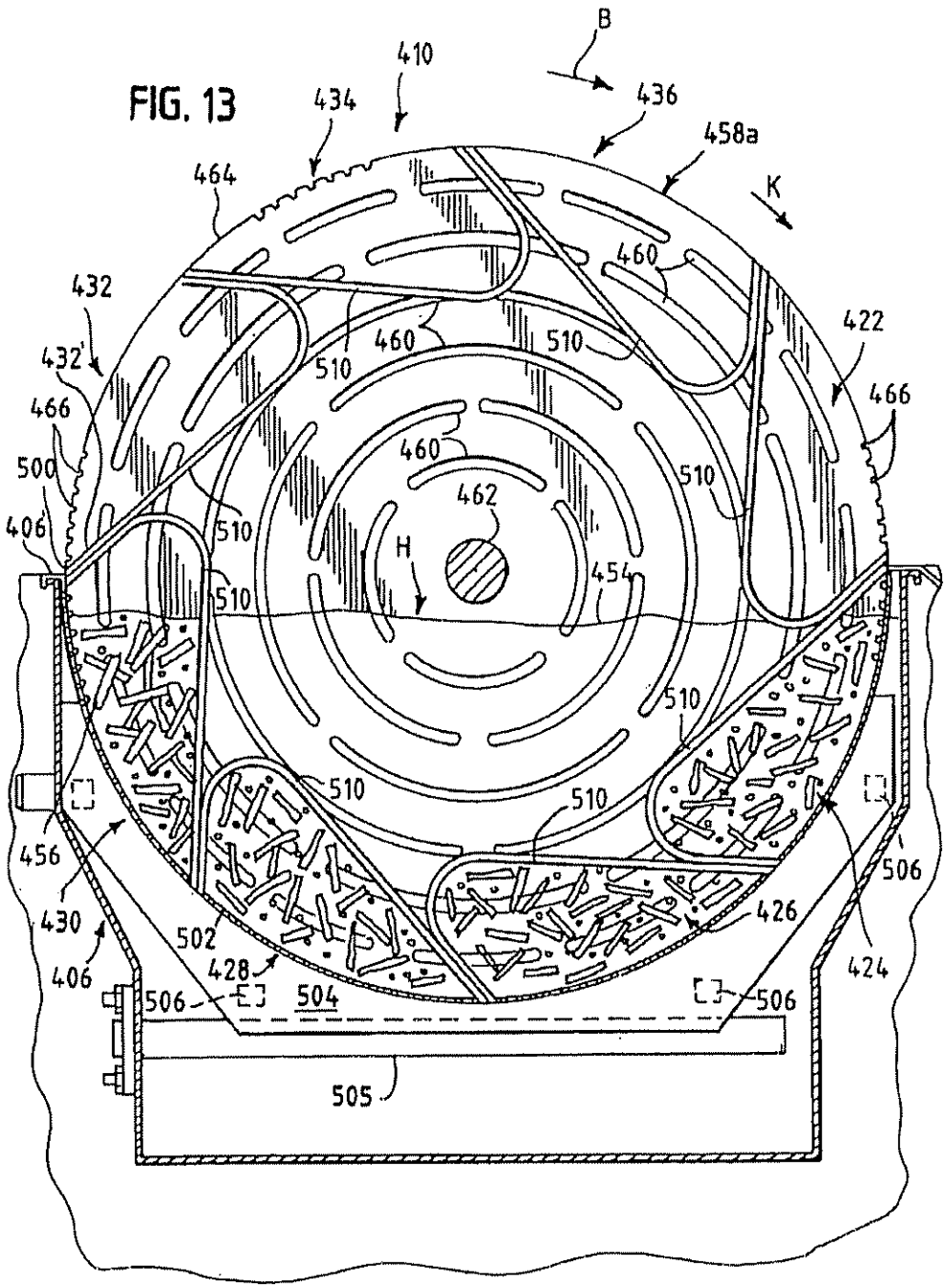
B
410
434
436
458a
K
464
460
432
422
432'
466
510
500
462
406
H
454
456
430
502
428
504
506
424
426
505

FIG. 14

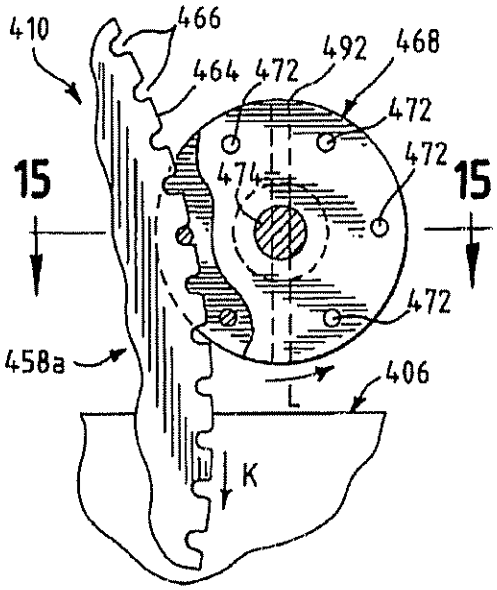

FIG. 15

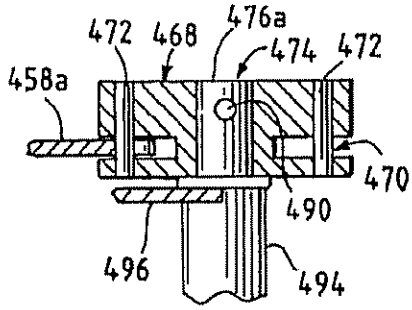

FIG. 16

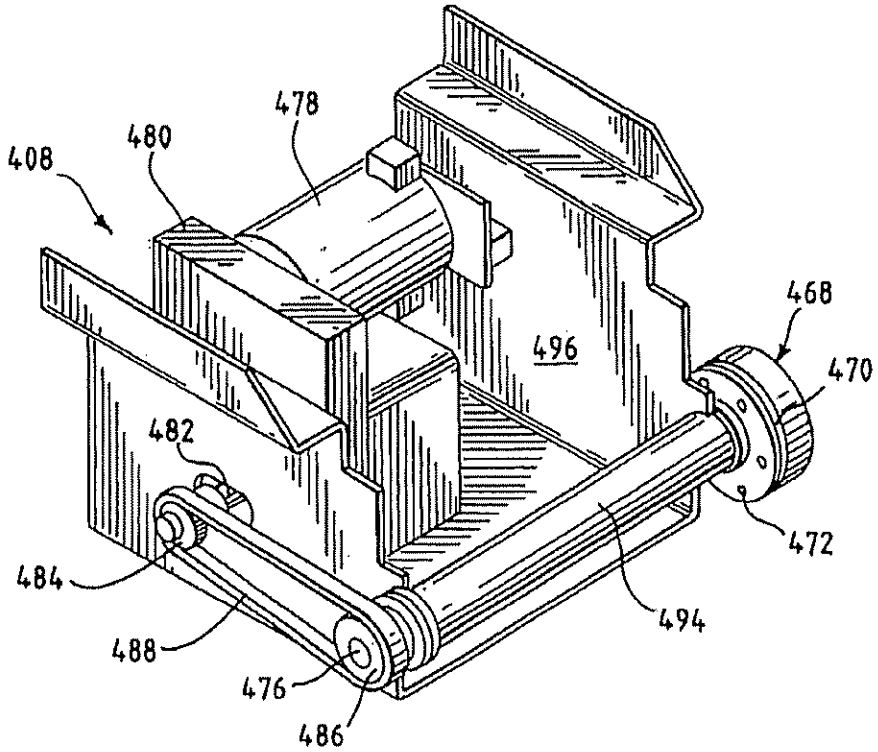

FIG. 17

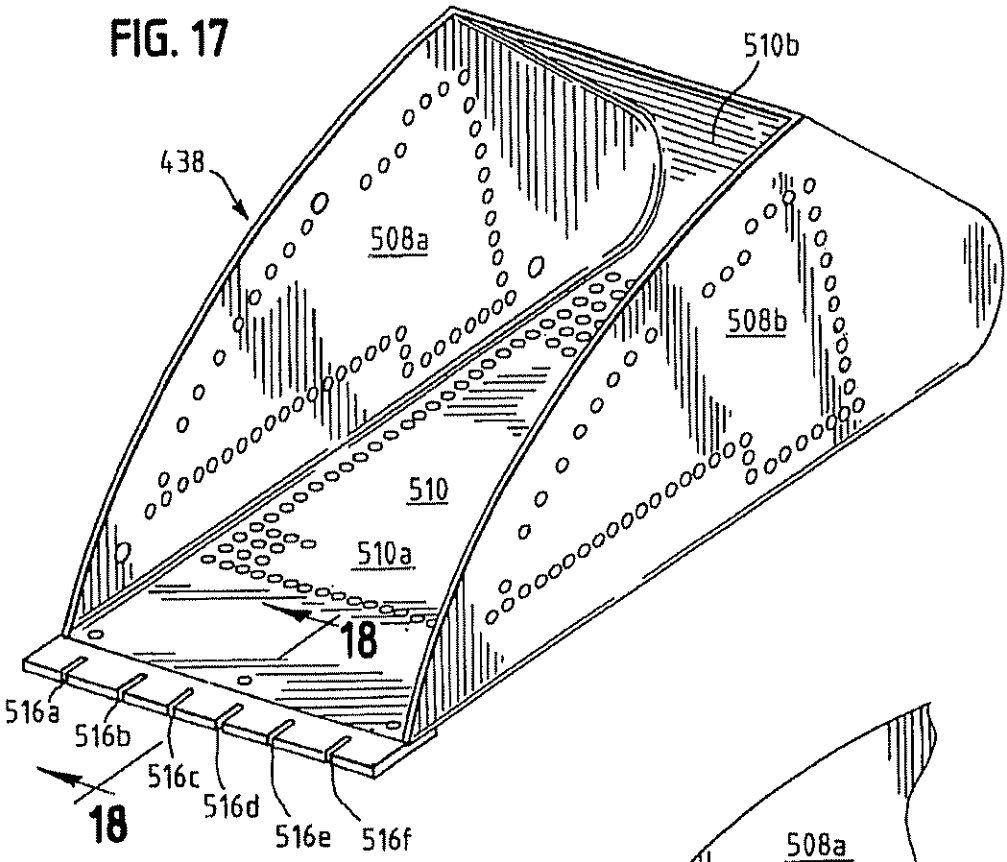

FIG. 18

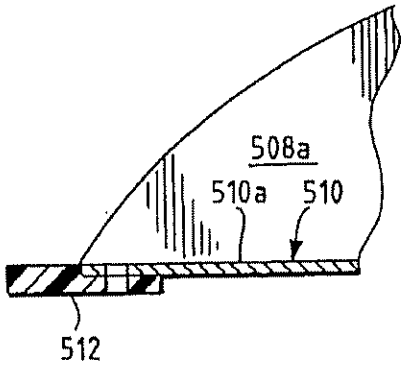

FIG. 19

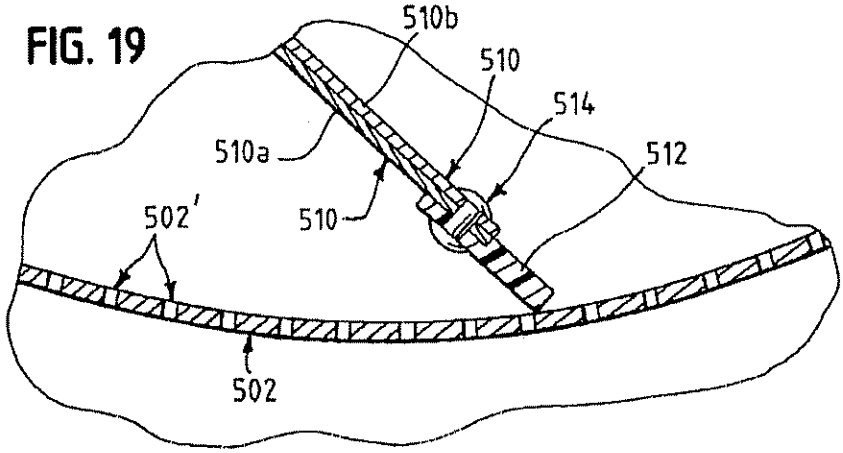

FIG. 20

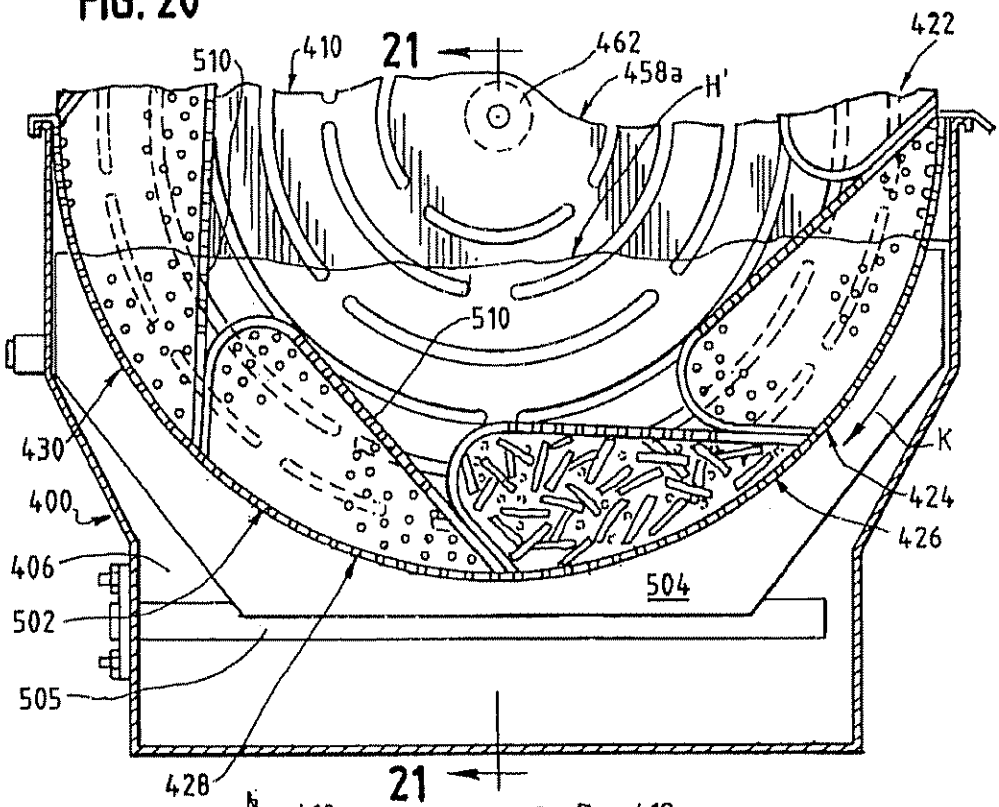

FIG. 21

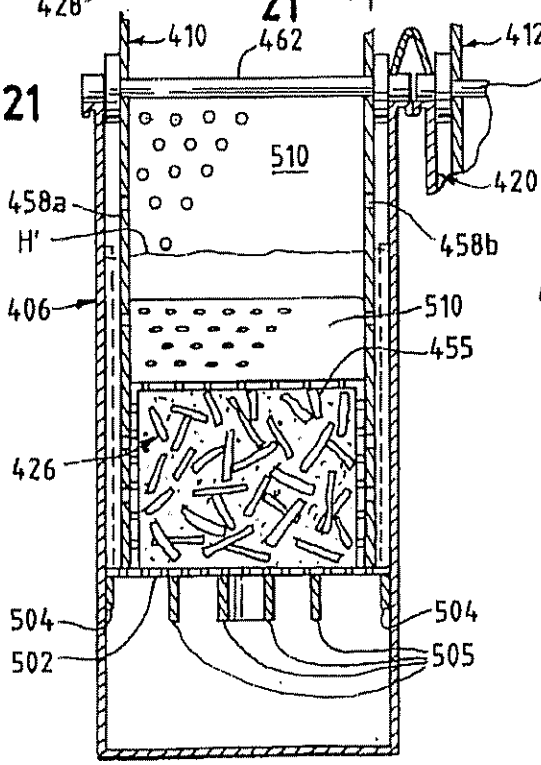

FIG. 22

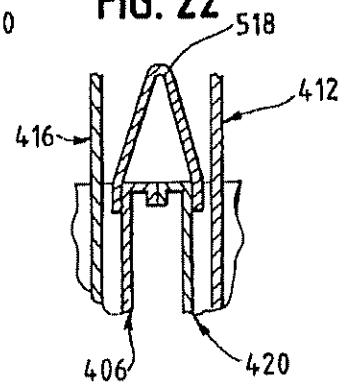

FIG. 23

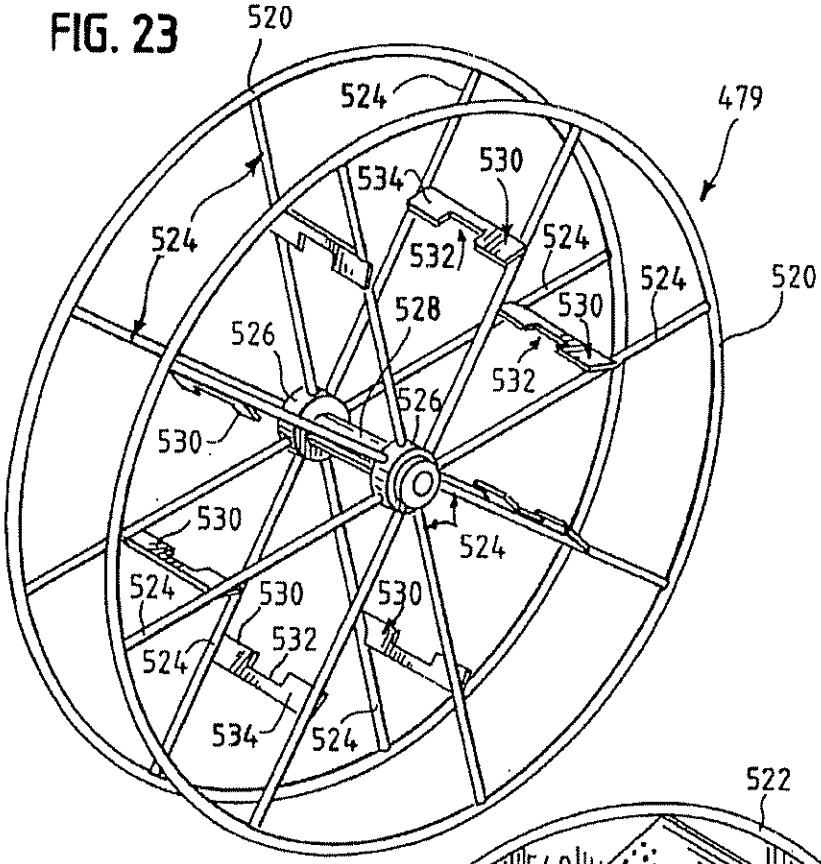
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FIG. 24

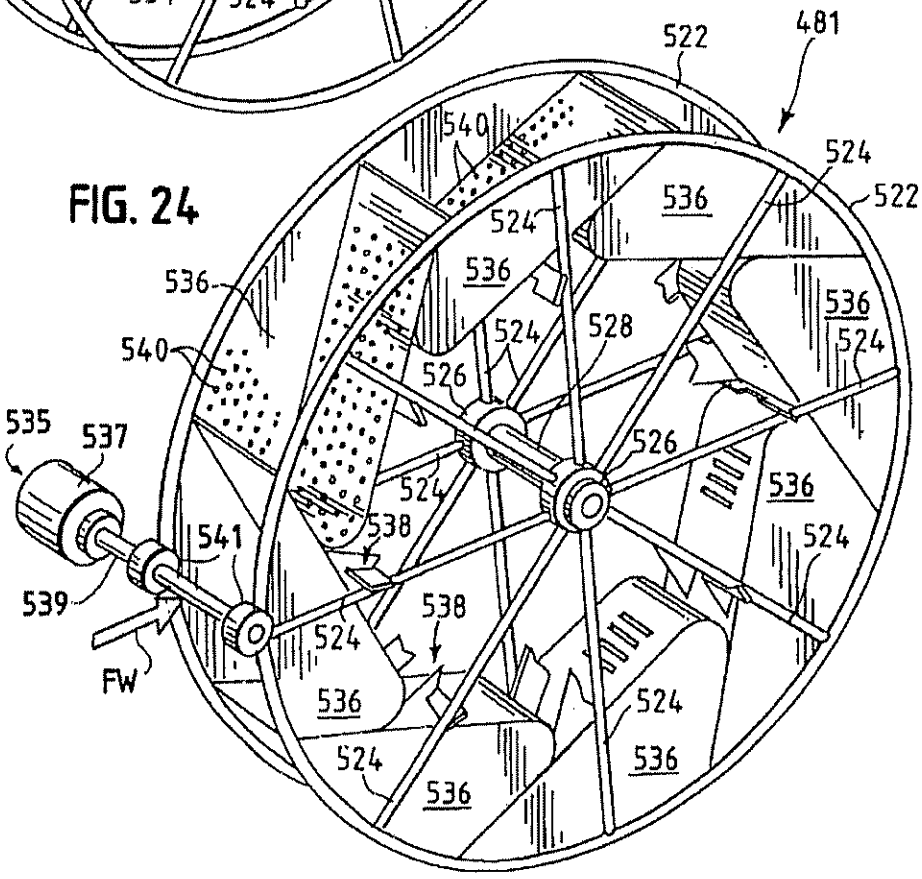
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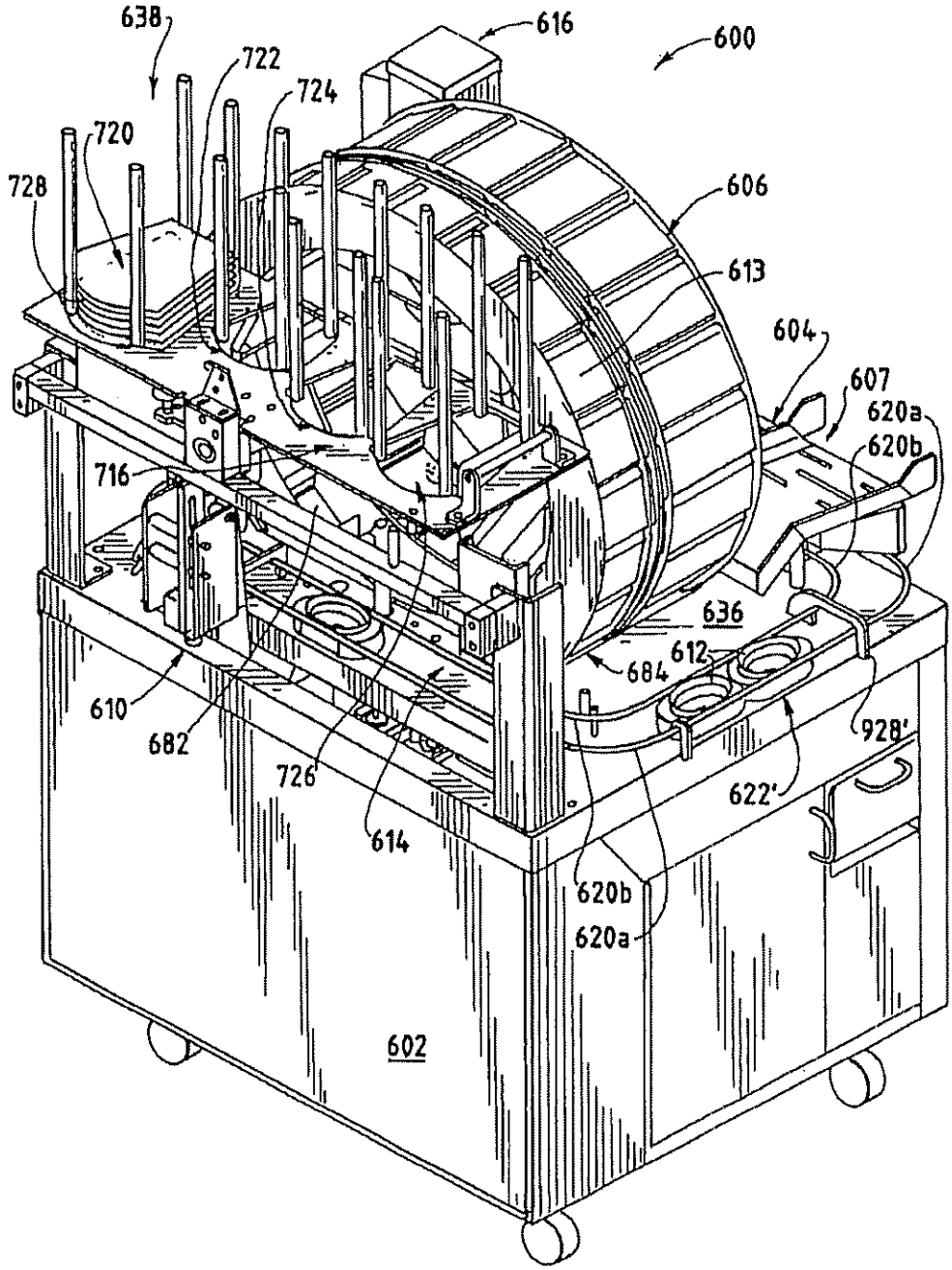
FIG. 25


638
722
724
616
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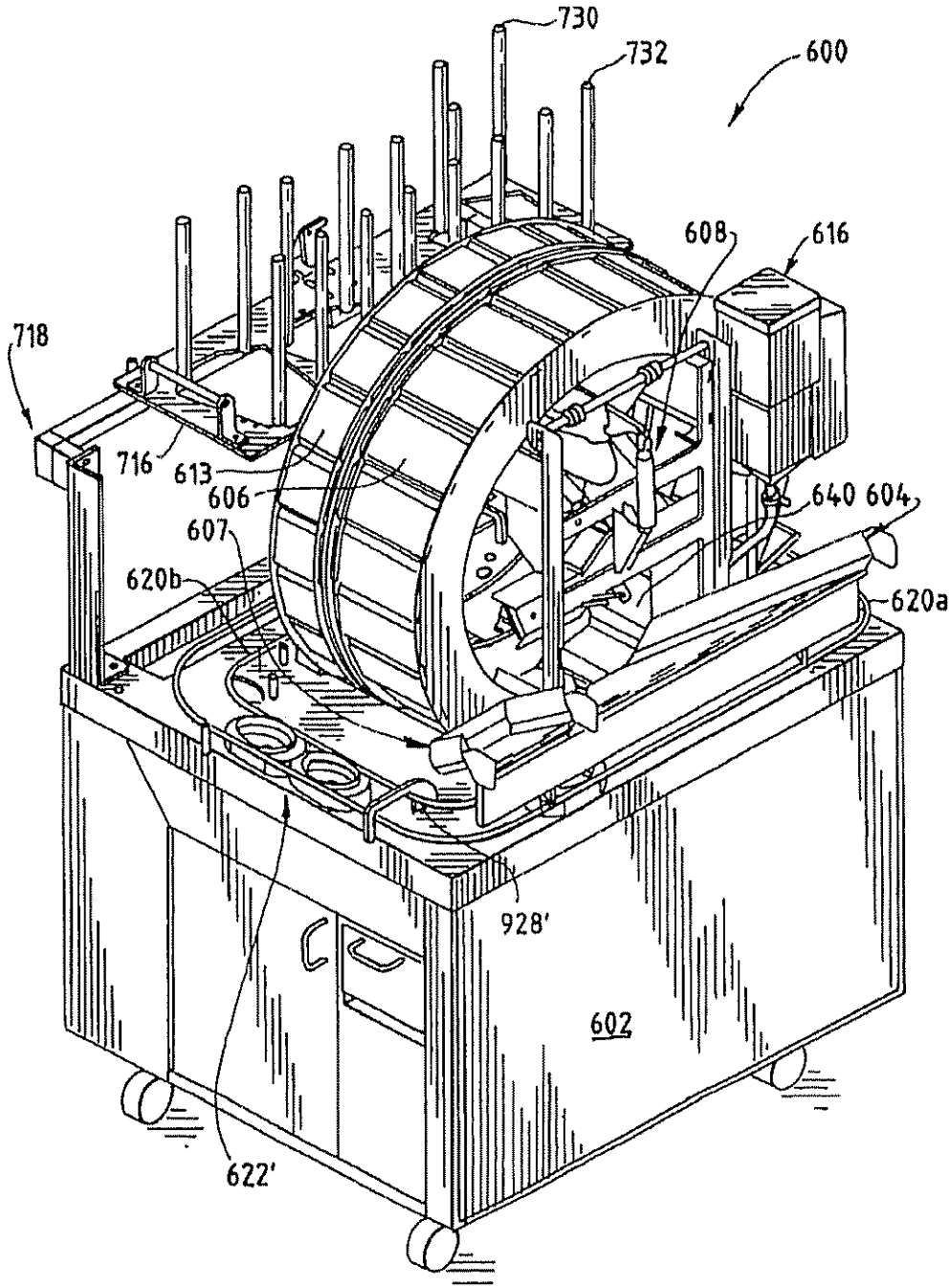
720
728
606
613
604
607
620a
620b
716
636
612
684
610
682
726
614
928'
622'
620b
620a
602

FIG. 26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732
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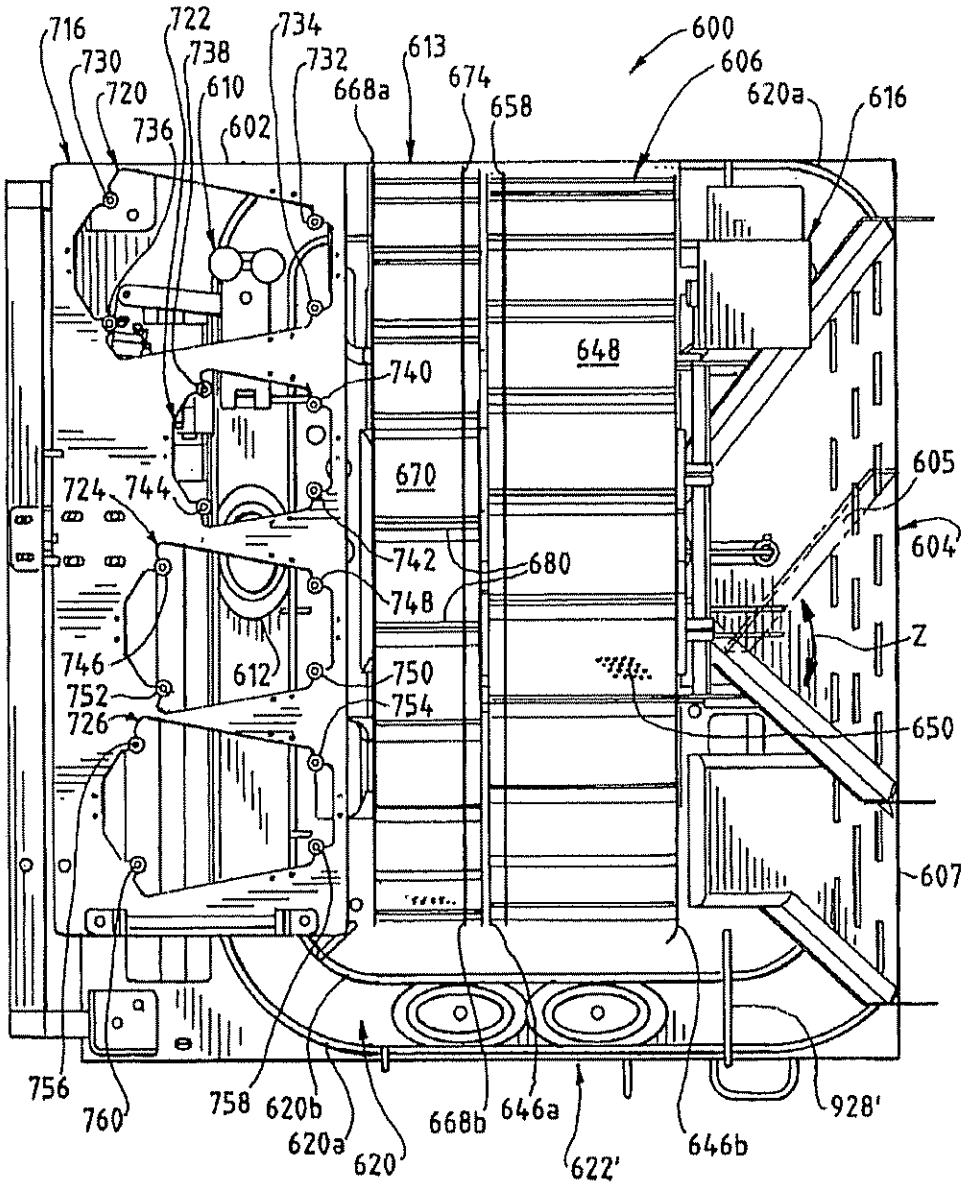
608
616
718
716
613
606
607
620b
640 604
620a
928'
602
622'

FIG. 27


716
730
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738
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734
732
668a
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674
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620a
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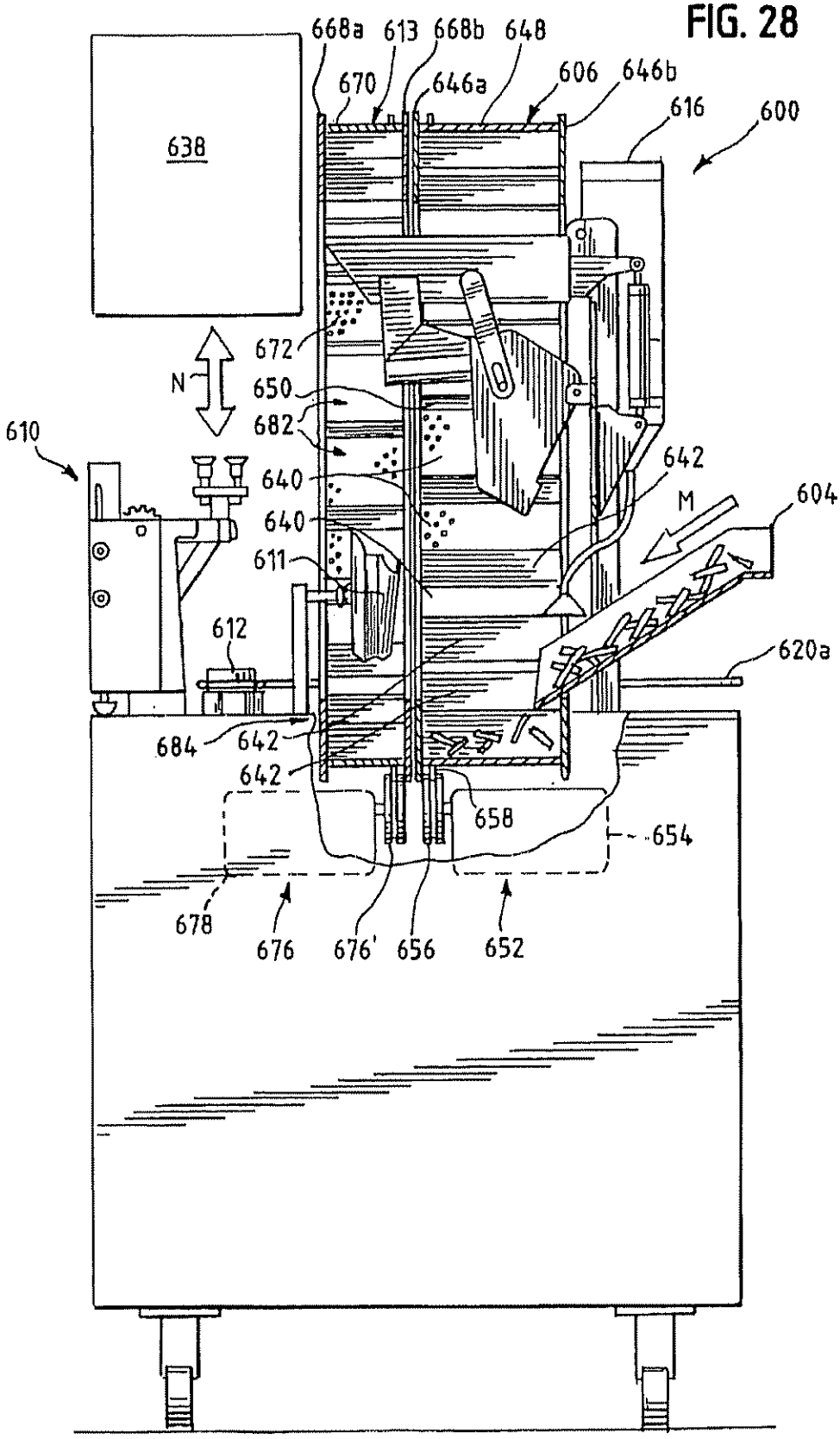
648
740
670
605
604
724
744
742
680
748
Z
746
752
726
612
750
754
650
607
756
760
758
620b
620a
620
668b
646a
622'
646b
928'

FIG. 28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646b
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638
672
N
650
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M
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640
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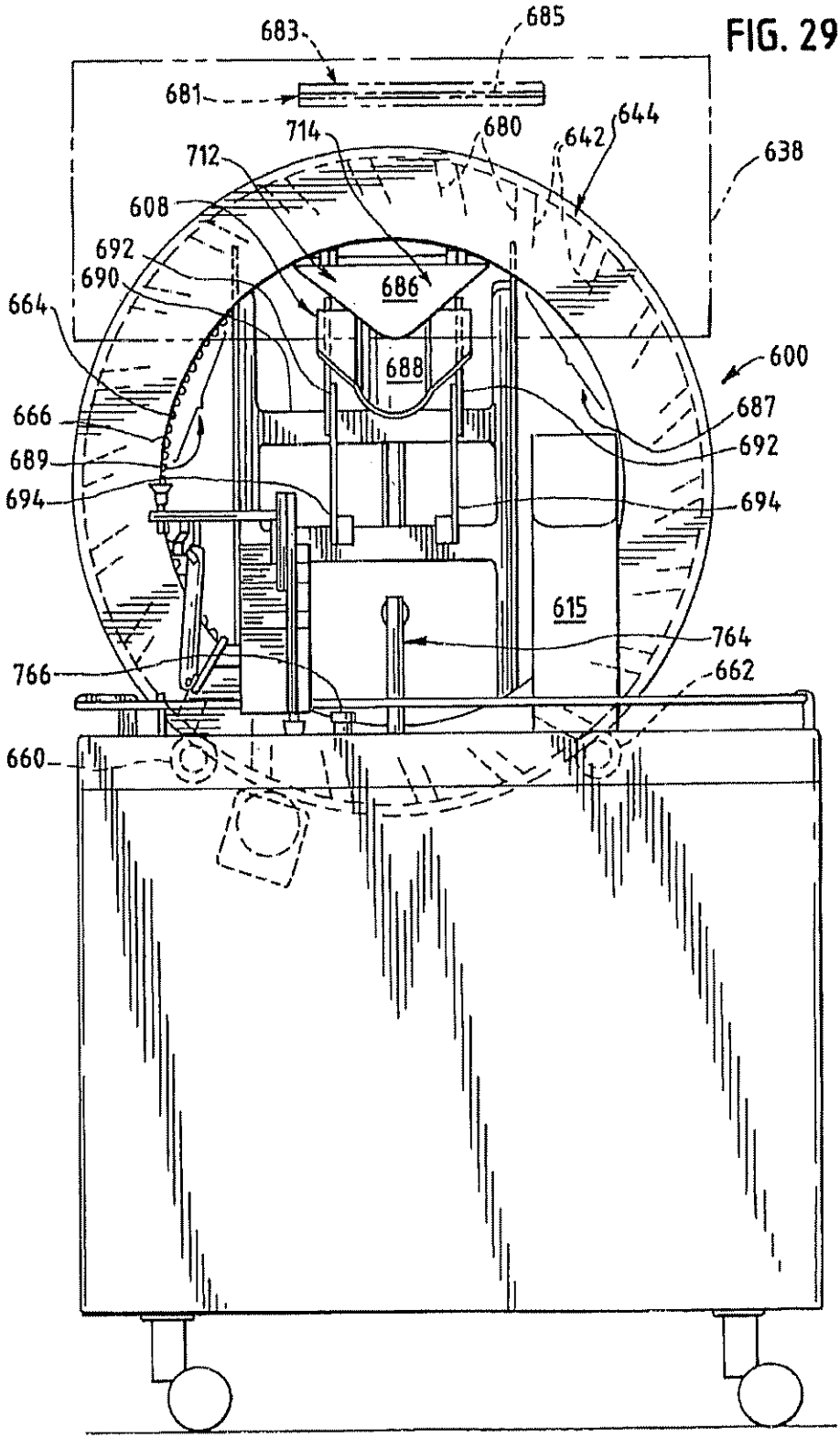
612
620a
684
642
642
658
654
678
676
676'
656
652

FIG. 29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694
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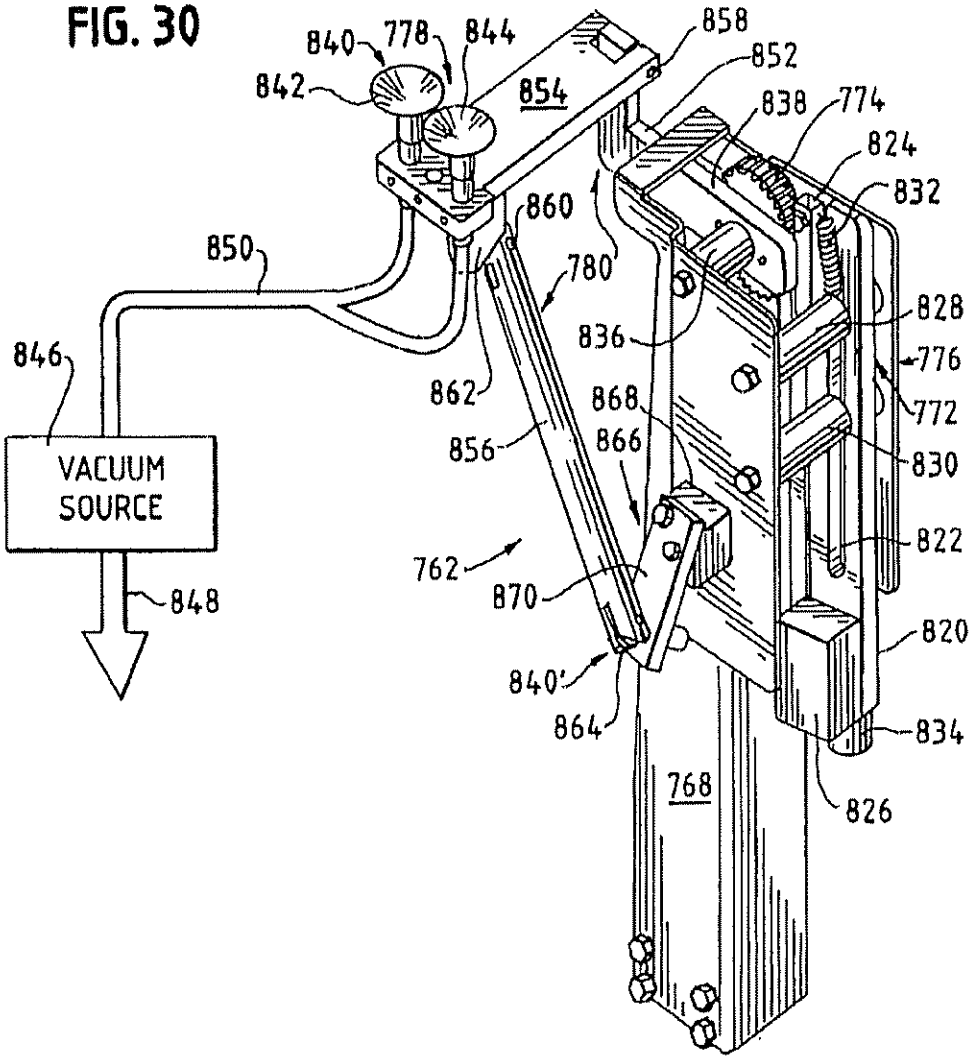
764
766
662
660

FIG. 30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850
780
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772
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866
830
VACUUM SOURCE
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820
840'
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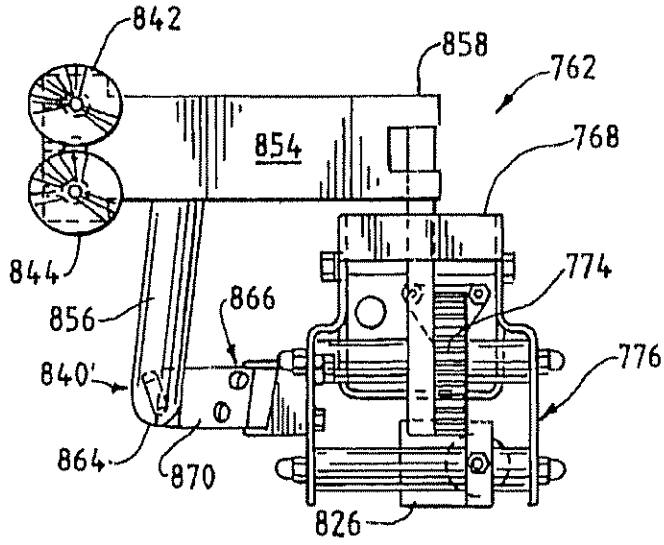
826

FIG. 31


842
858
762
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768
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774
856
866
840'
776
864
870
826

FIG. 32

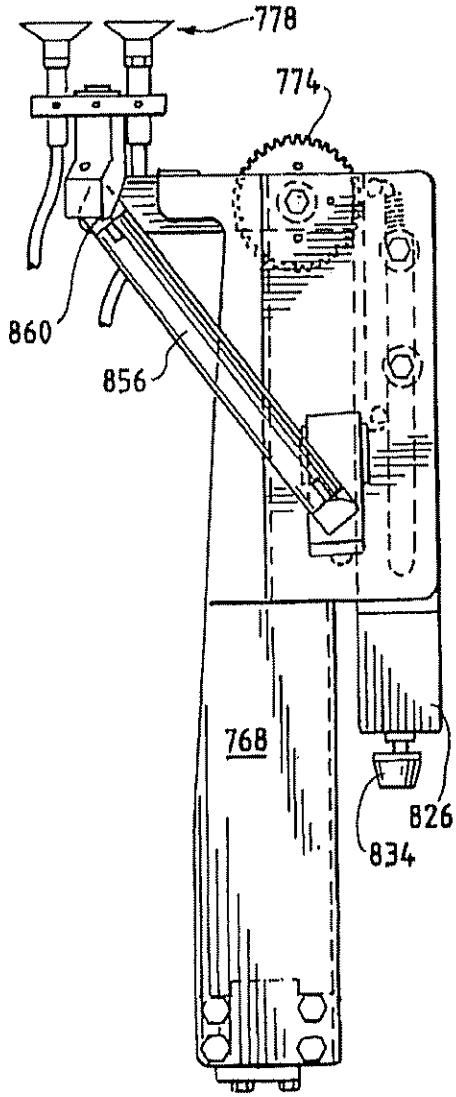
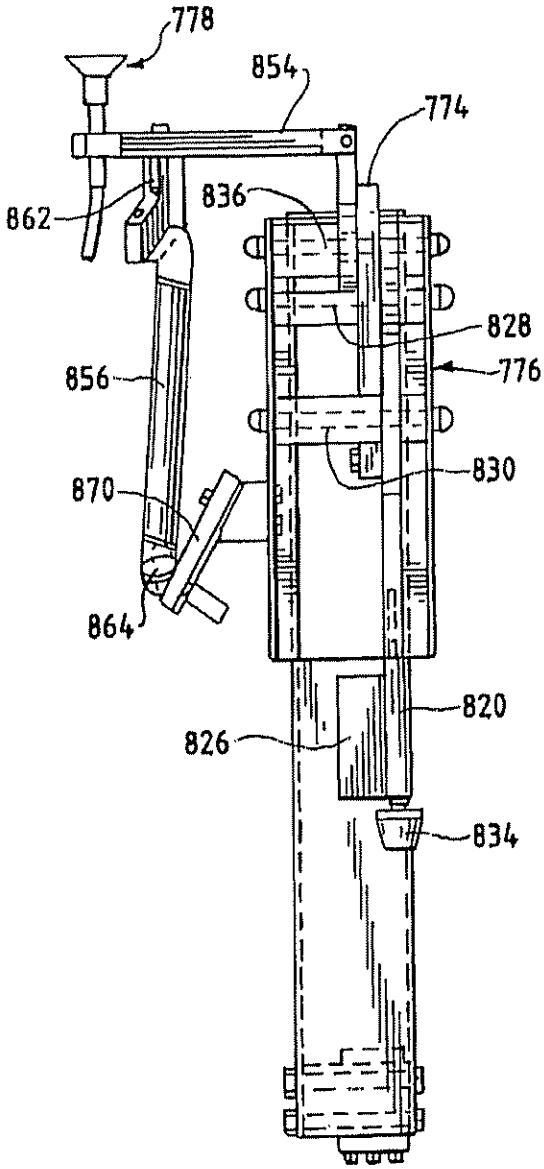

778
774
860
856
768
826
834

FIG. 33


778
854
774
862
836
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856
776
870
830
864
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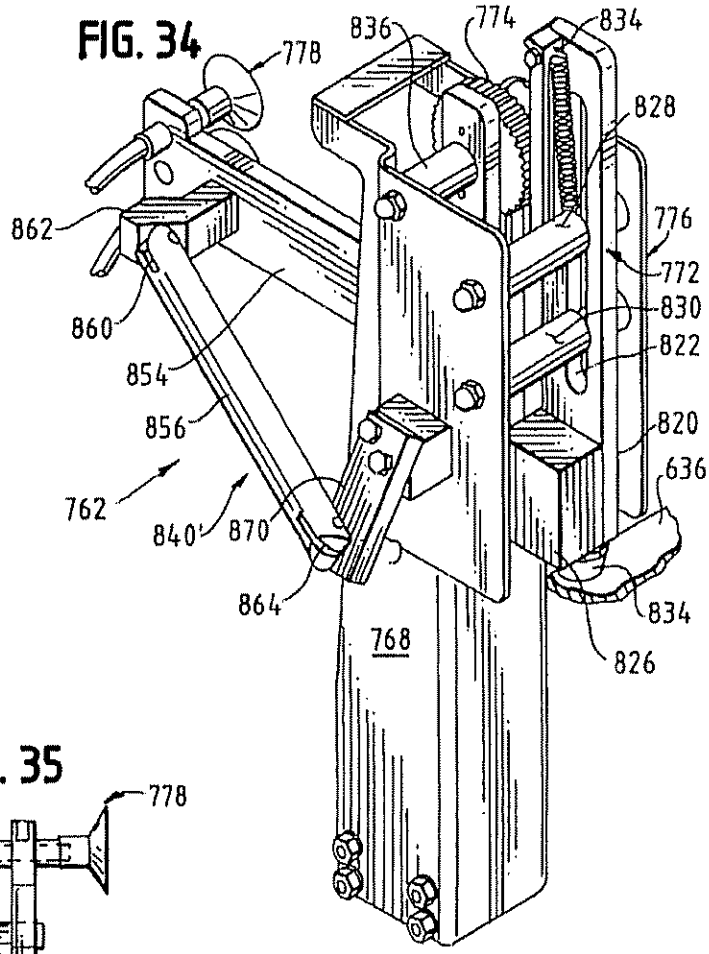
834

FIG. 34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762
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870
864
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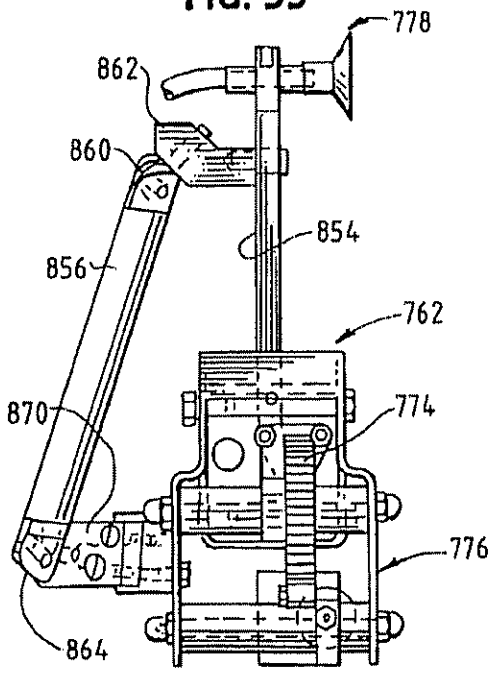
768
826

FIG. 35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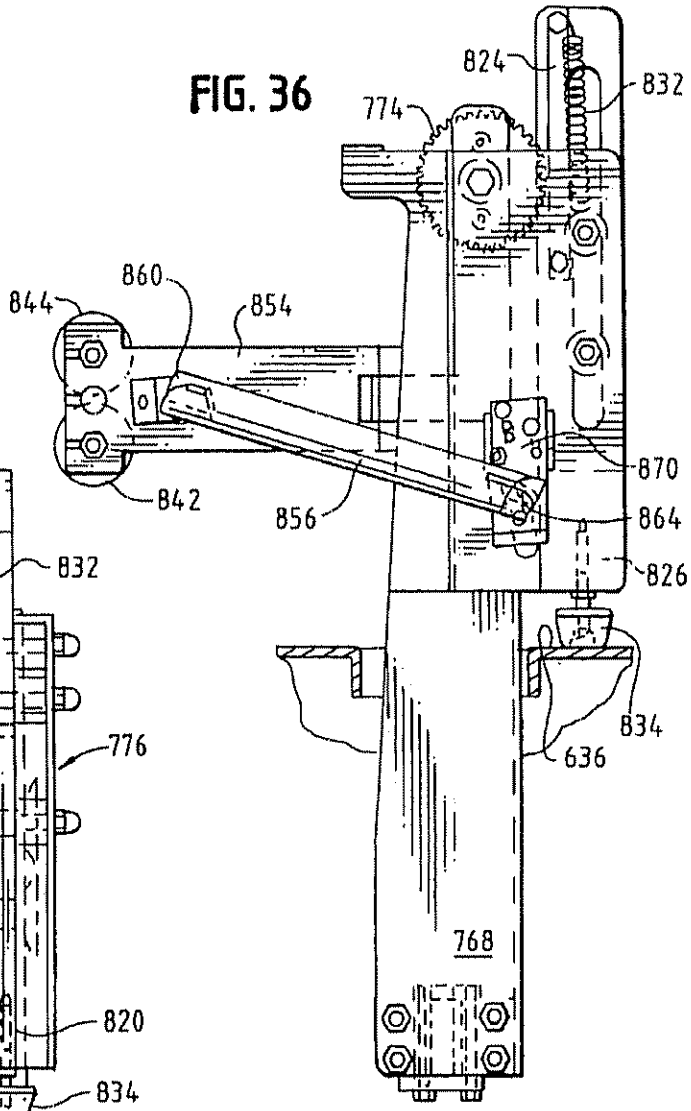
860
854
856
762
870
774
776
864

FIG. 36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774
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844
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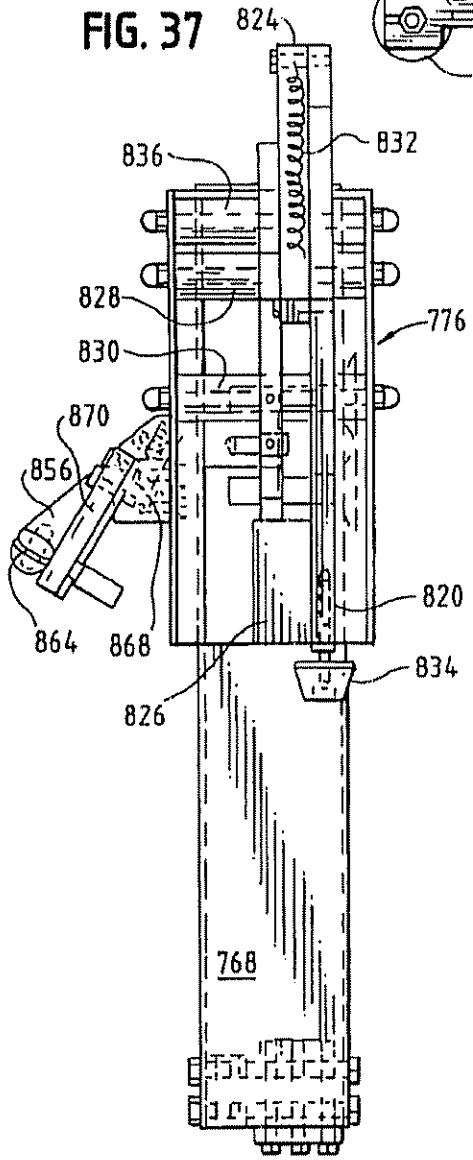
870
842
856
864
826
834
636
768

FIG. 37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864
868
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826
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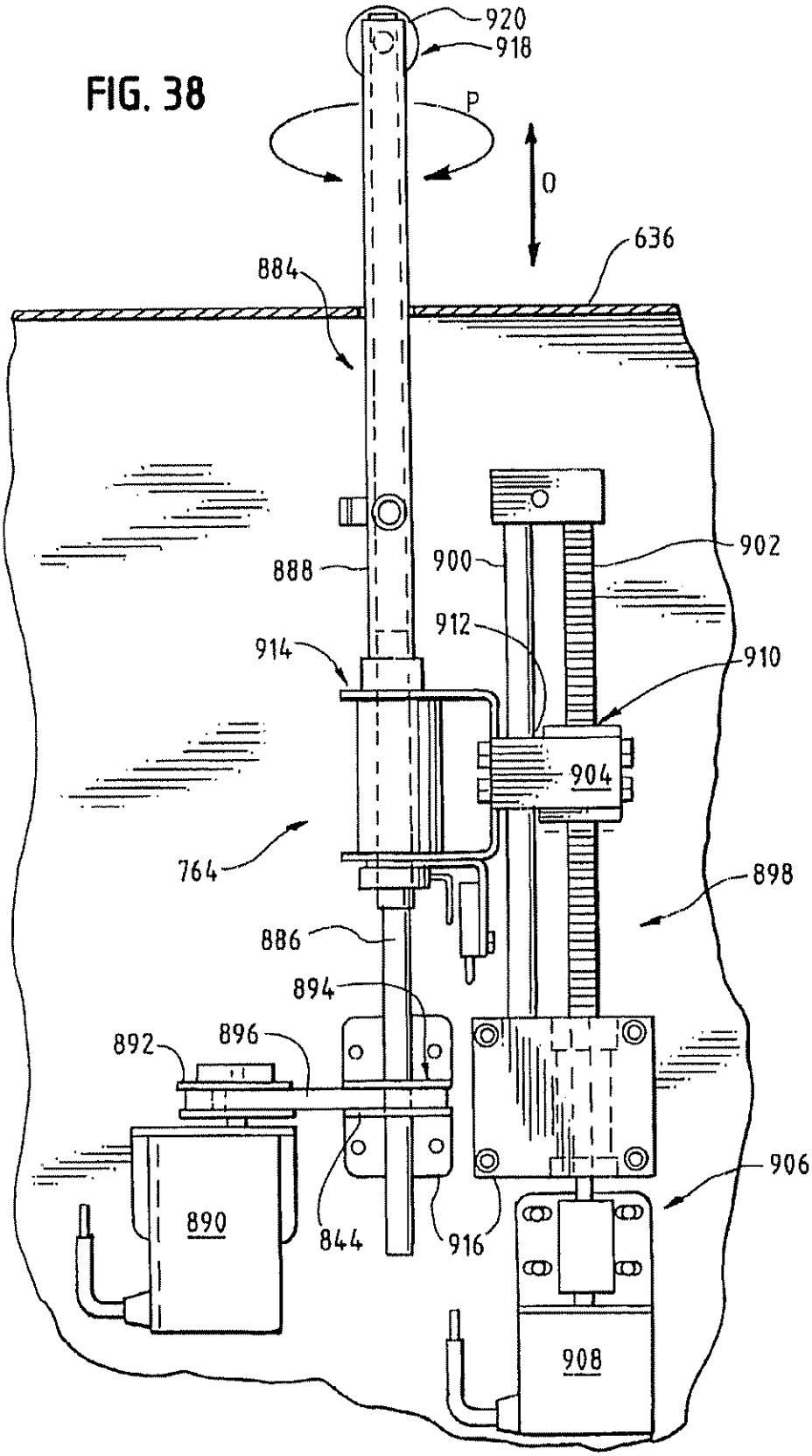
FIG. 38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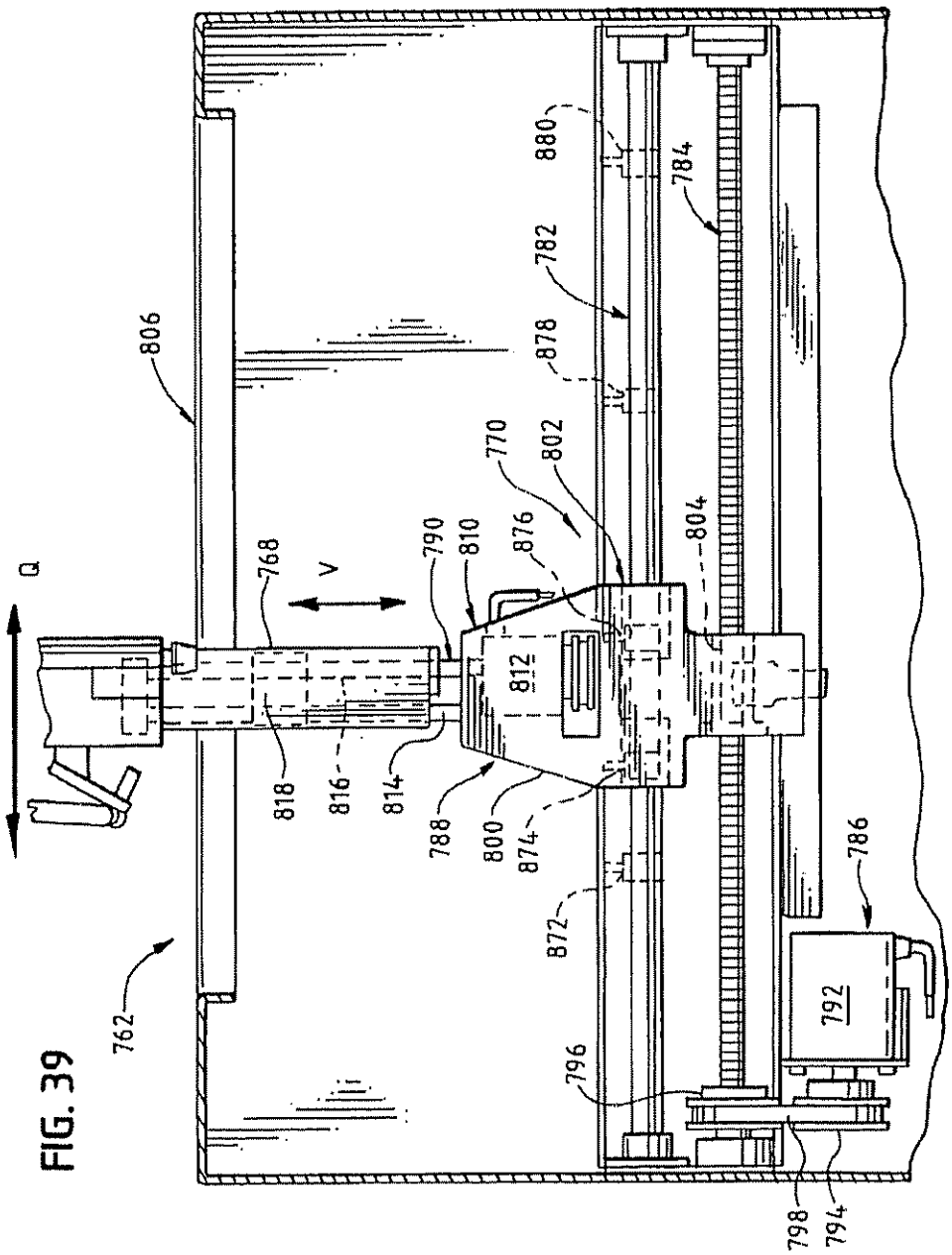
908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874
872
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762
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794

FIG. 39

FIG. 40

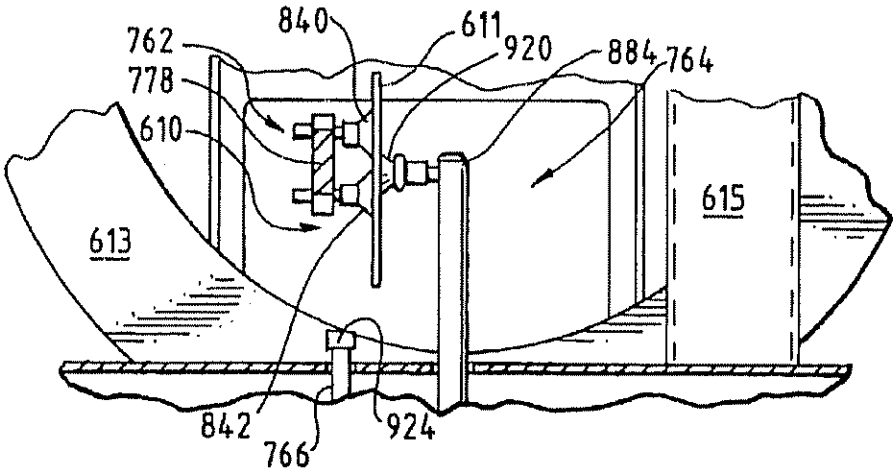


FIG. 41

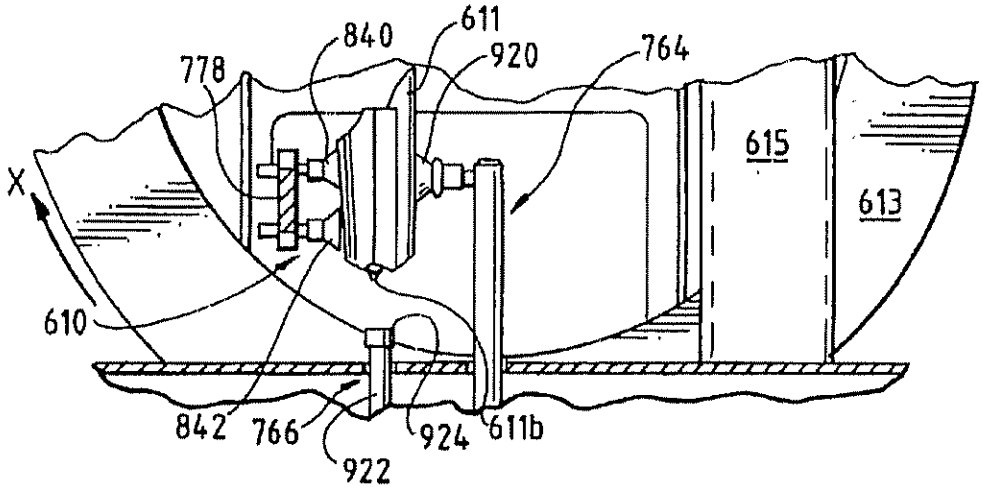


FIG. 42

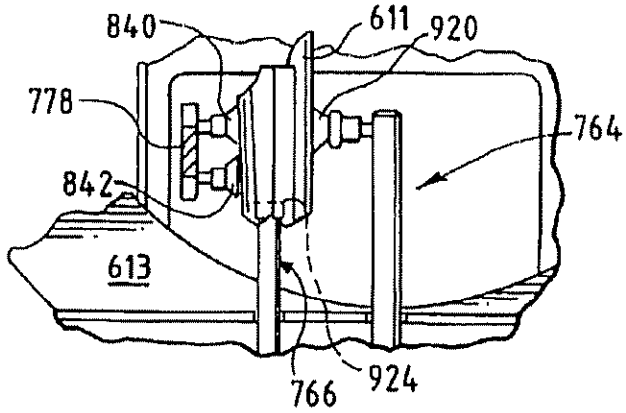
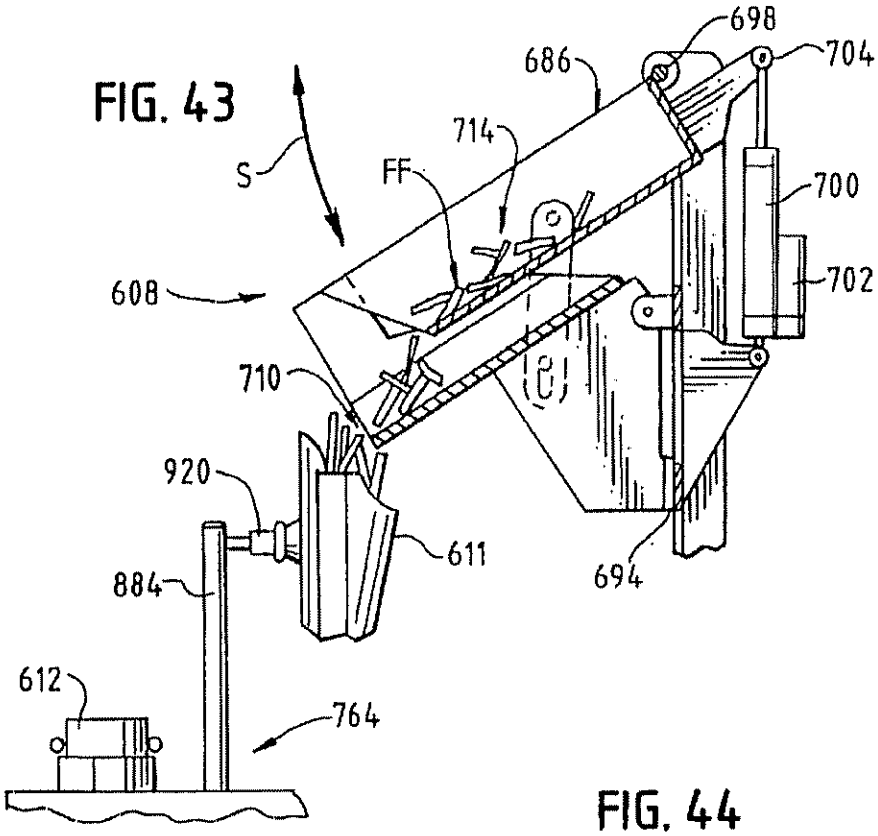


FIG. 43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714
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FF
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702
710
920
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884
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612
764

FIG. 44

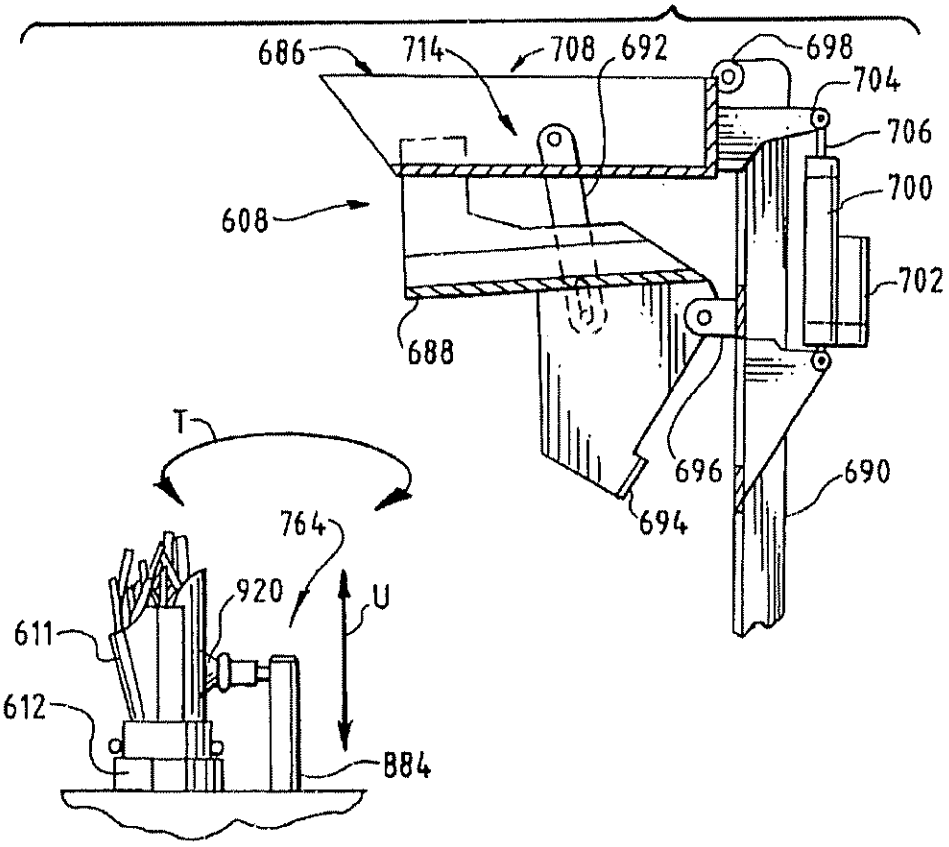
686
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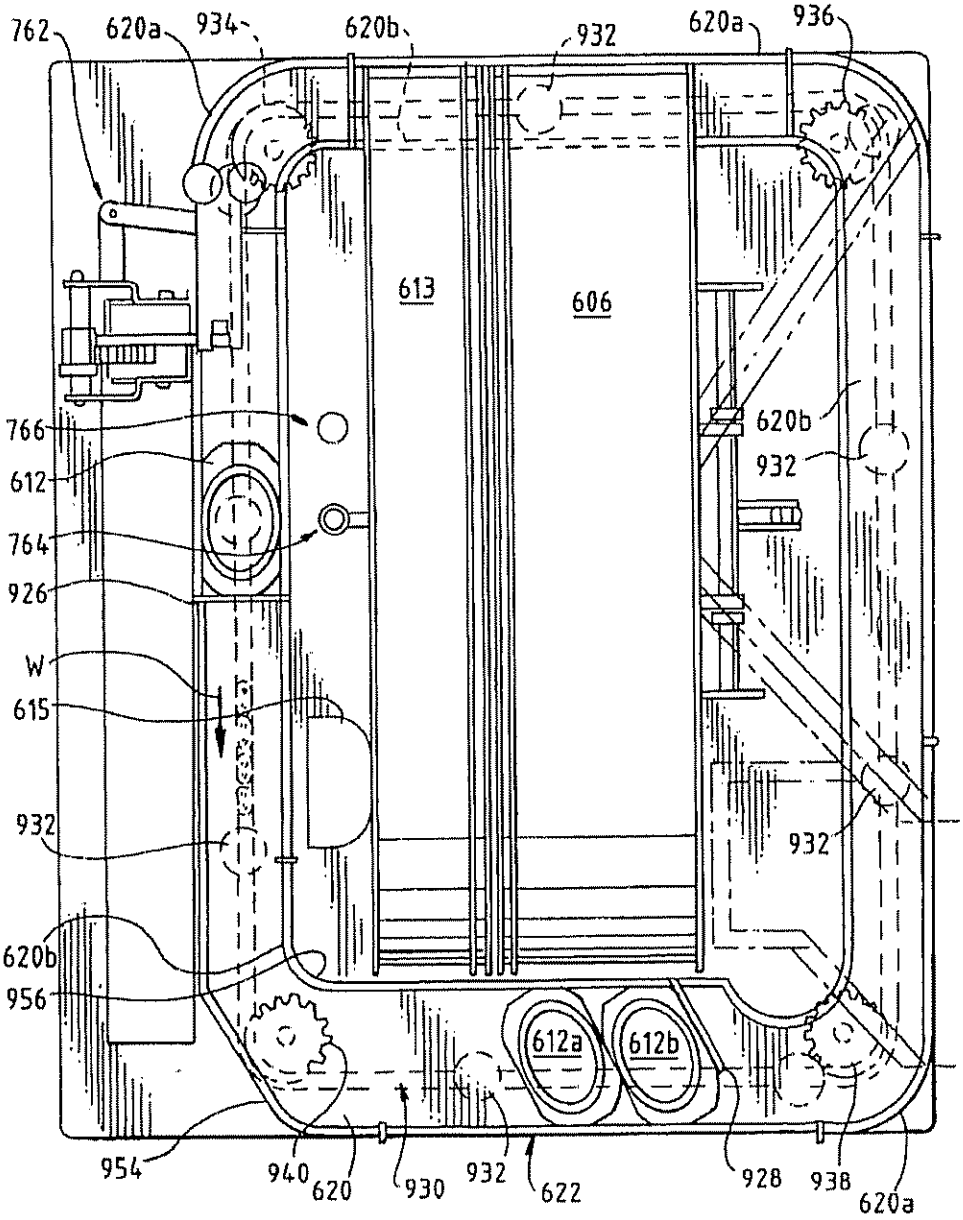
FIG. 45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W
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612a
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932
932
928
938
620a

FIG. 46

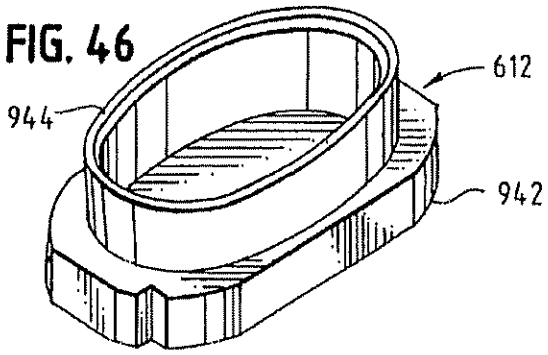


FIG. 47

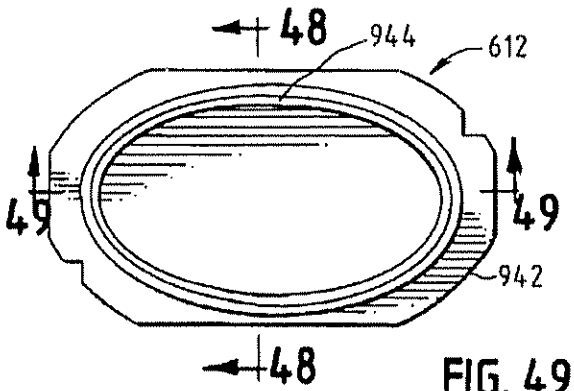


FIG. 48

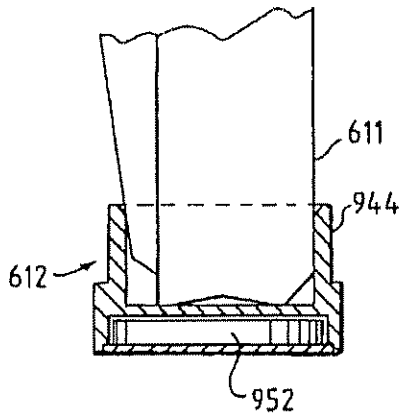


FIG. 49

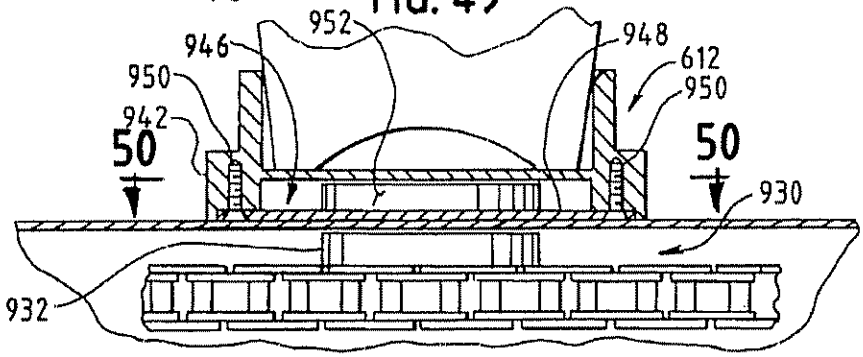


FIG. 50

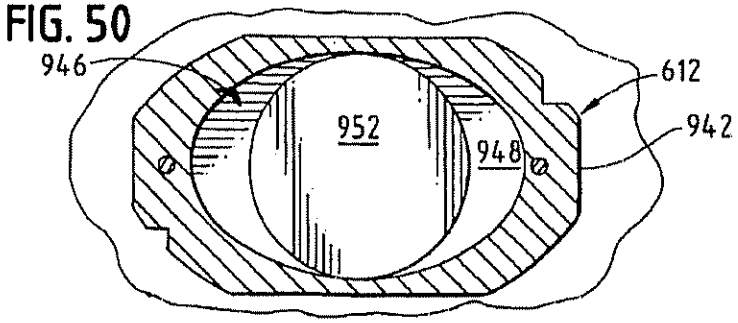


FIG. 51

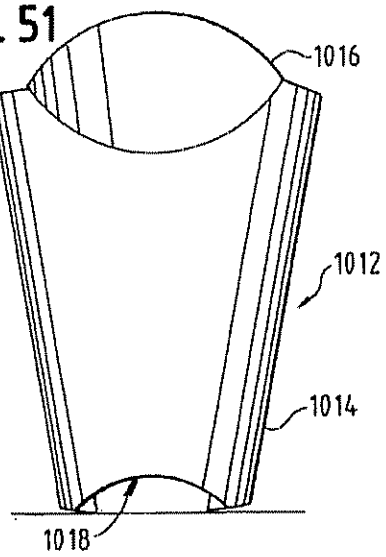


FIG. 52

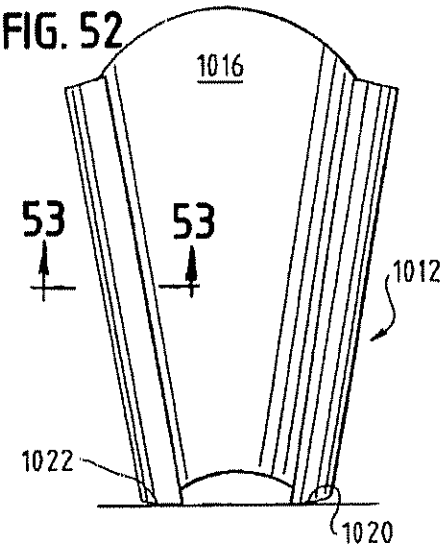


FIG. 53

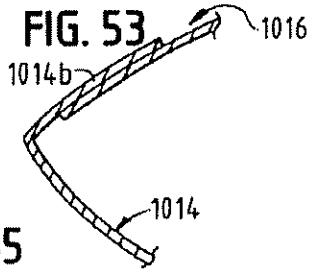


FIG. 54

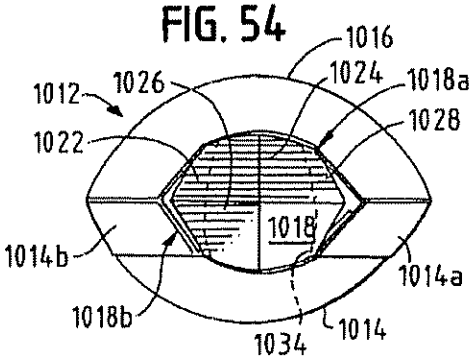


FIG. 55

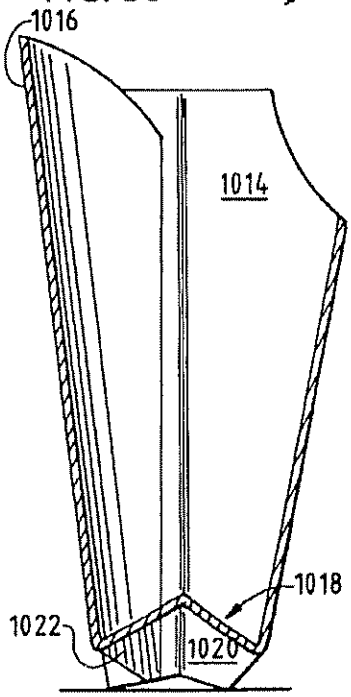


FIG. 56

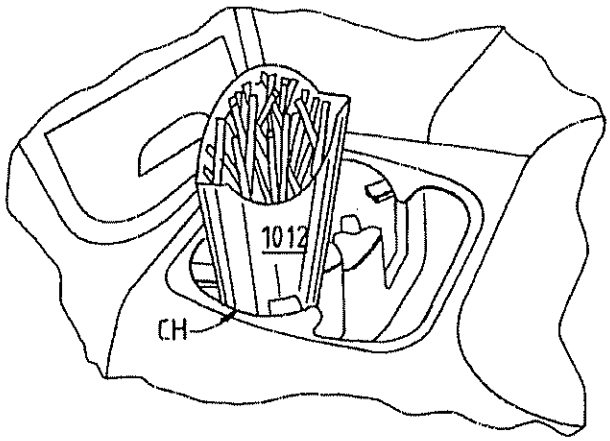


FIG. 57

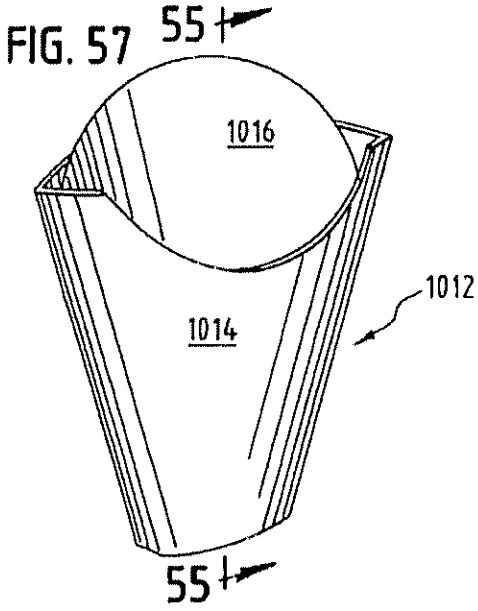


FIG. 58

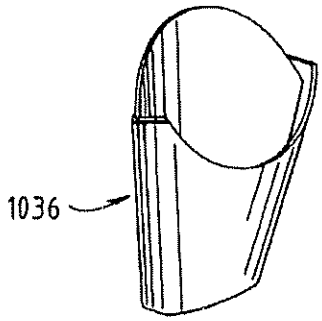


FIG. 59

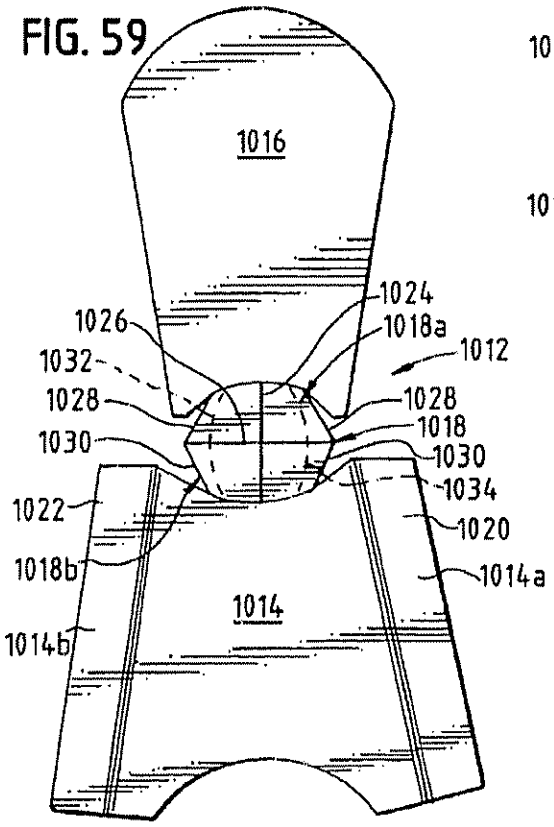


FIG. 60

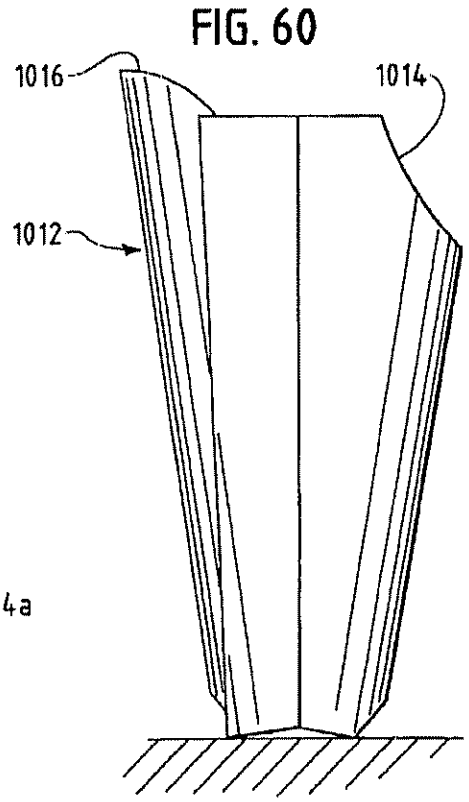


FIG. 61

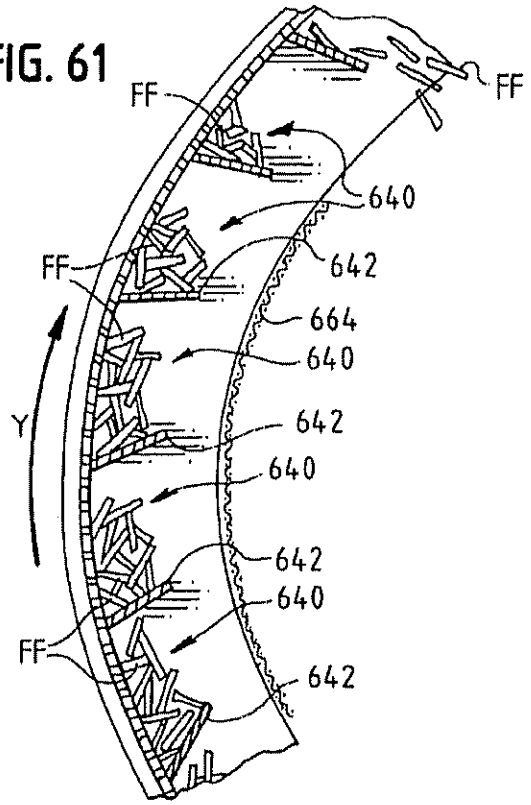


FIG. 62

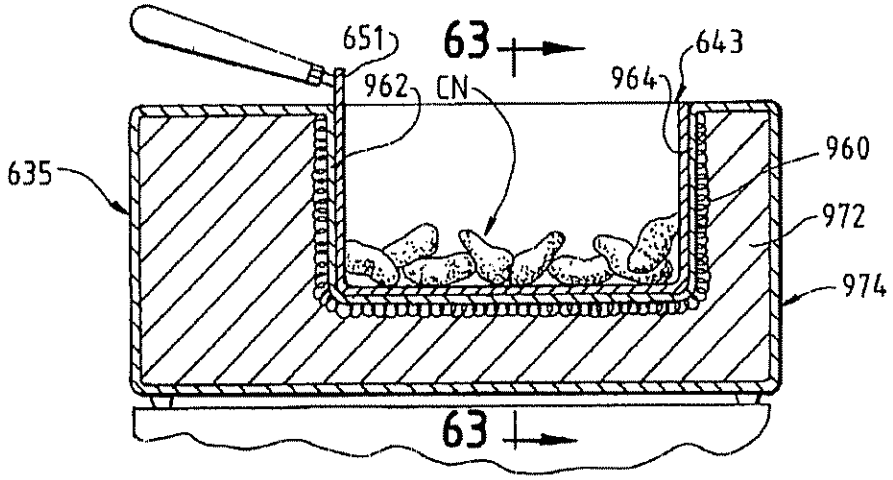


FIG. 63

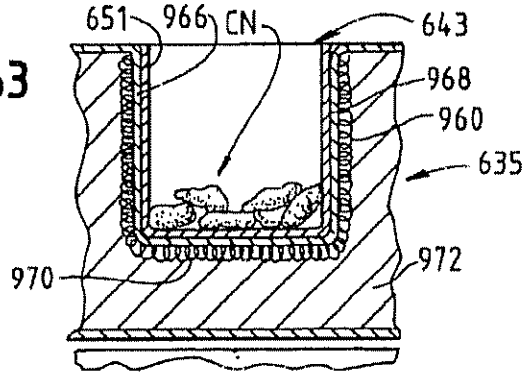


FIG. 64

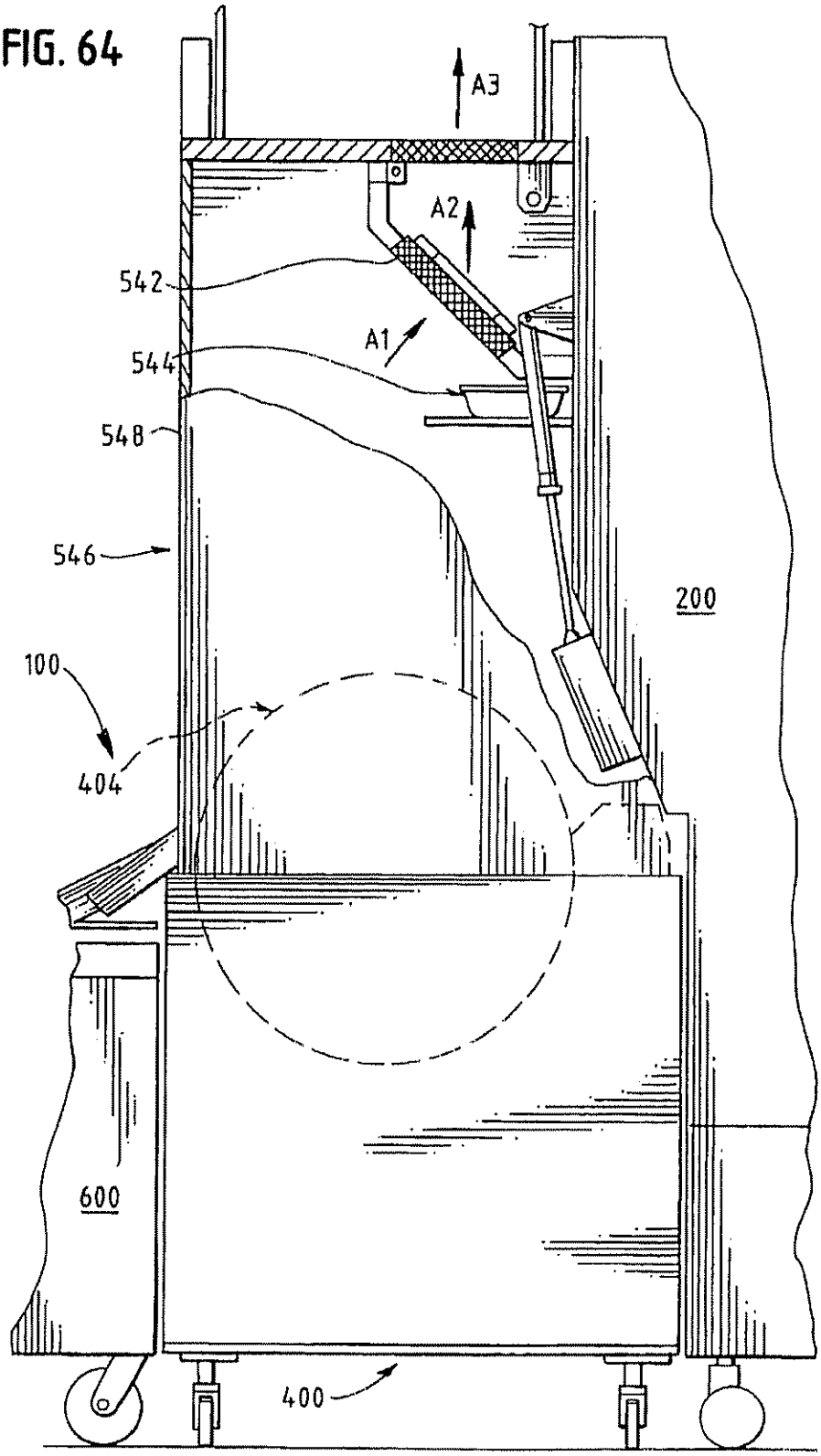


FIG. 65

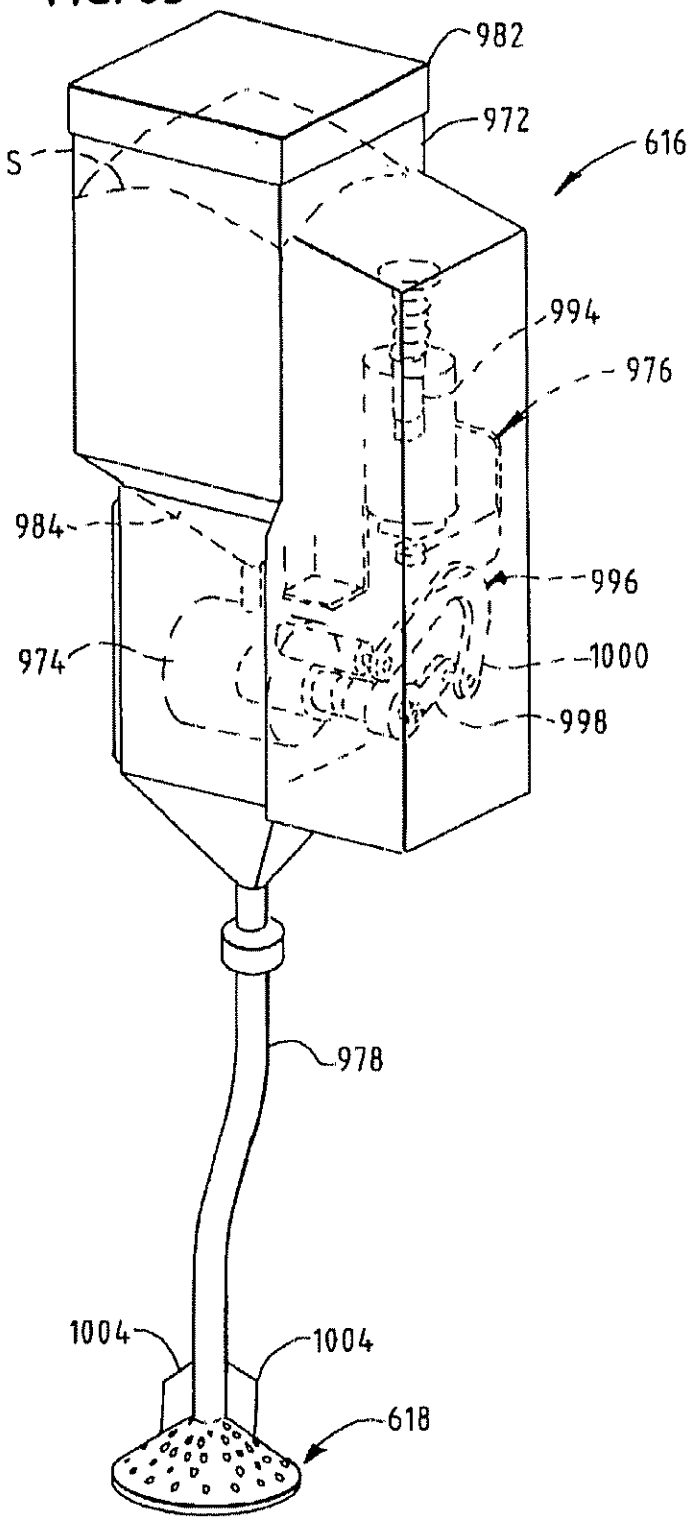


FIG. 66

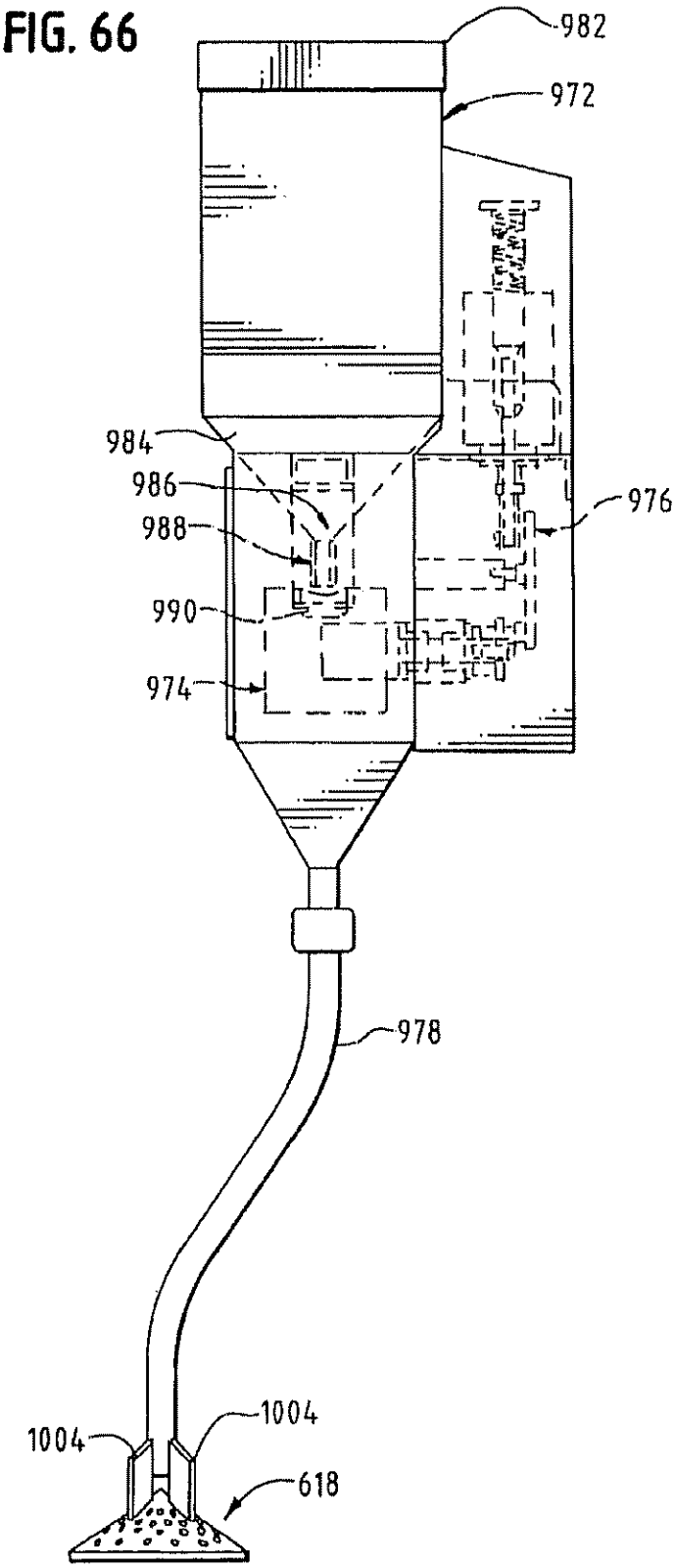


FIG. 67

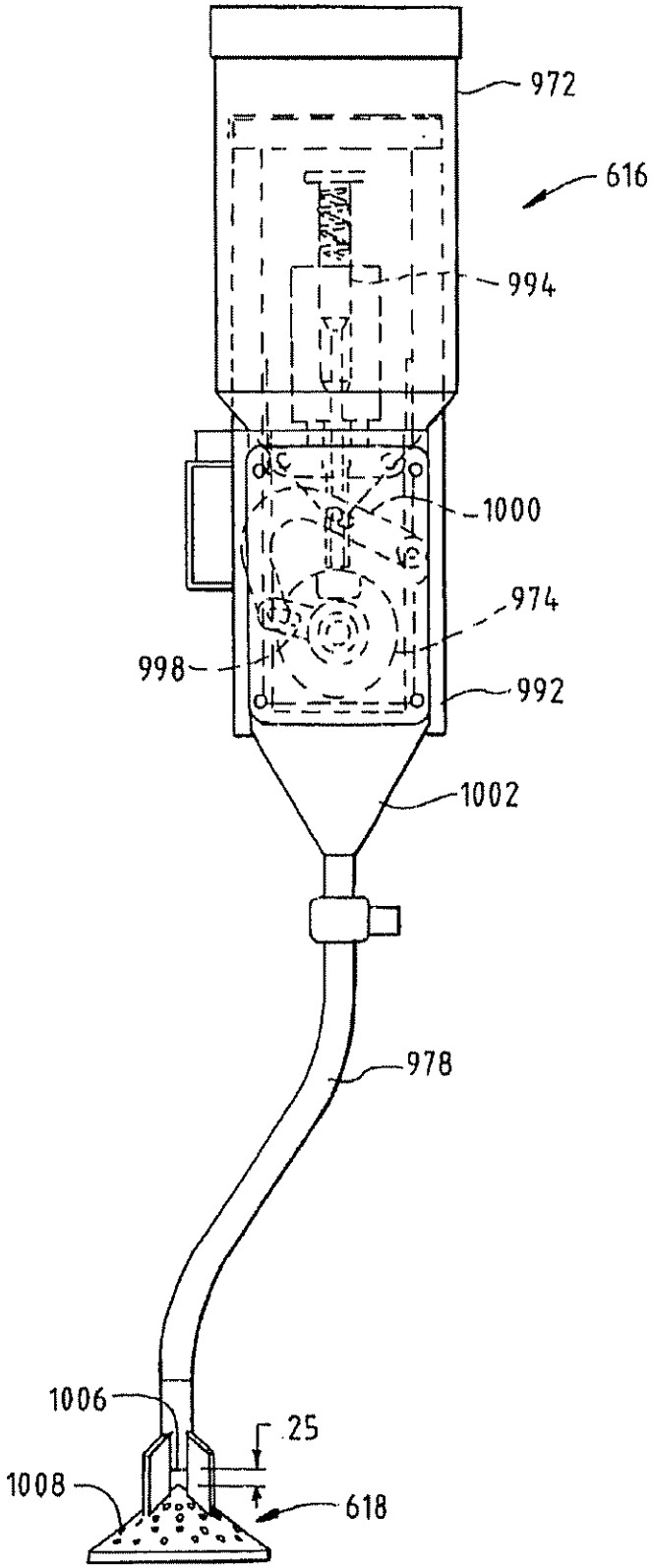


FIG. 68

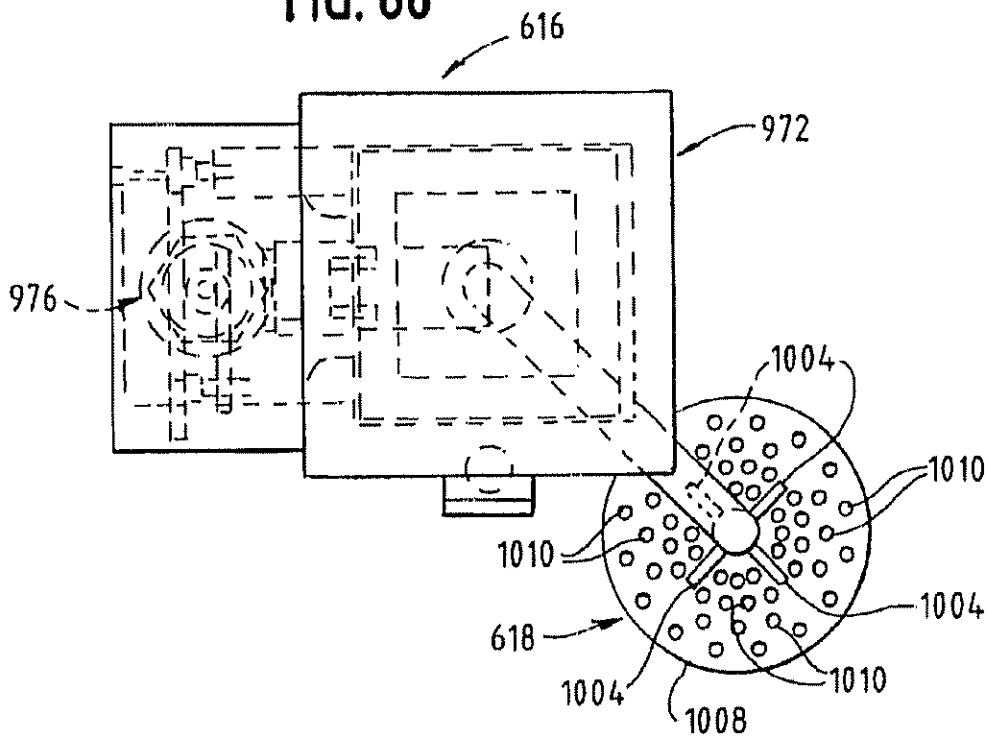


FIG. 69

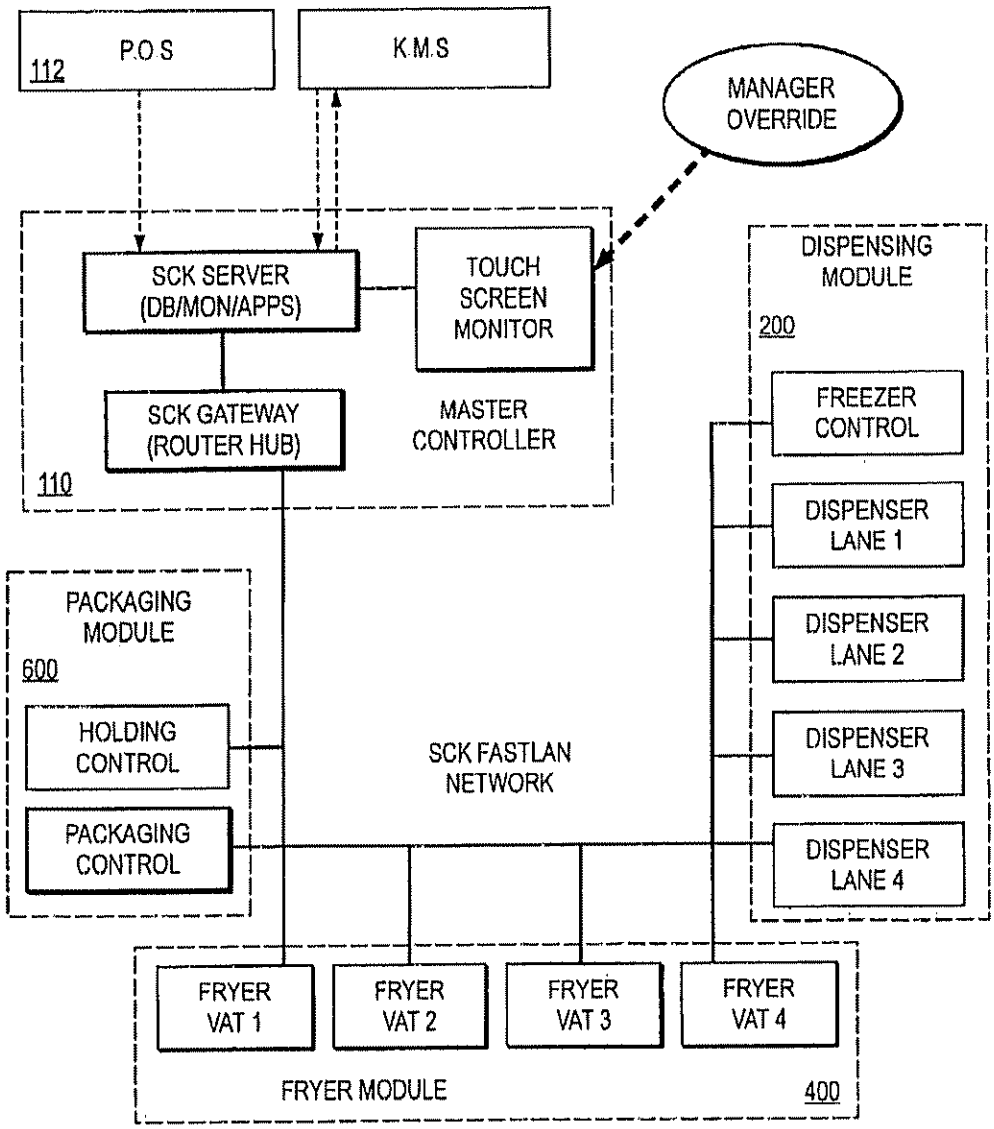

P.O.S
112
K.M.S
MANAGER OVERRIDE
SCK SERVER (DB/MON/APPS)
TOUCH SCREEN MONITOR
SCK GATEWAY (ROUTER HUB)
MASTER CONTROLLER
110
DISPENSING MODULE
200
FREEZER CONTROL
DISPENSER LANE 1
DISPENSER LANE 2
DISPENSER LANE 3
DISPENSER LANE 4
PACKAGING MODULE
600
HOLDING CONTROL
PACKAGING CONTROL
SCK FASTLAN NETWORK
FRYER VAT 1
FRYER VAT 2
FRYER VAT 3
FRYER VAT 4
FRYER MODULE
400

FIG. 70

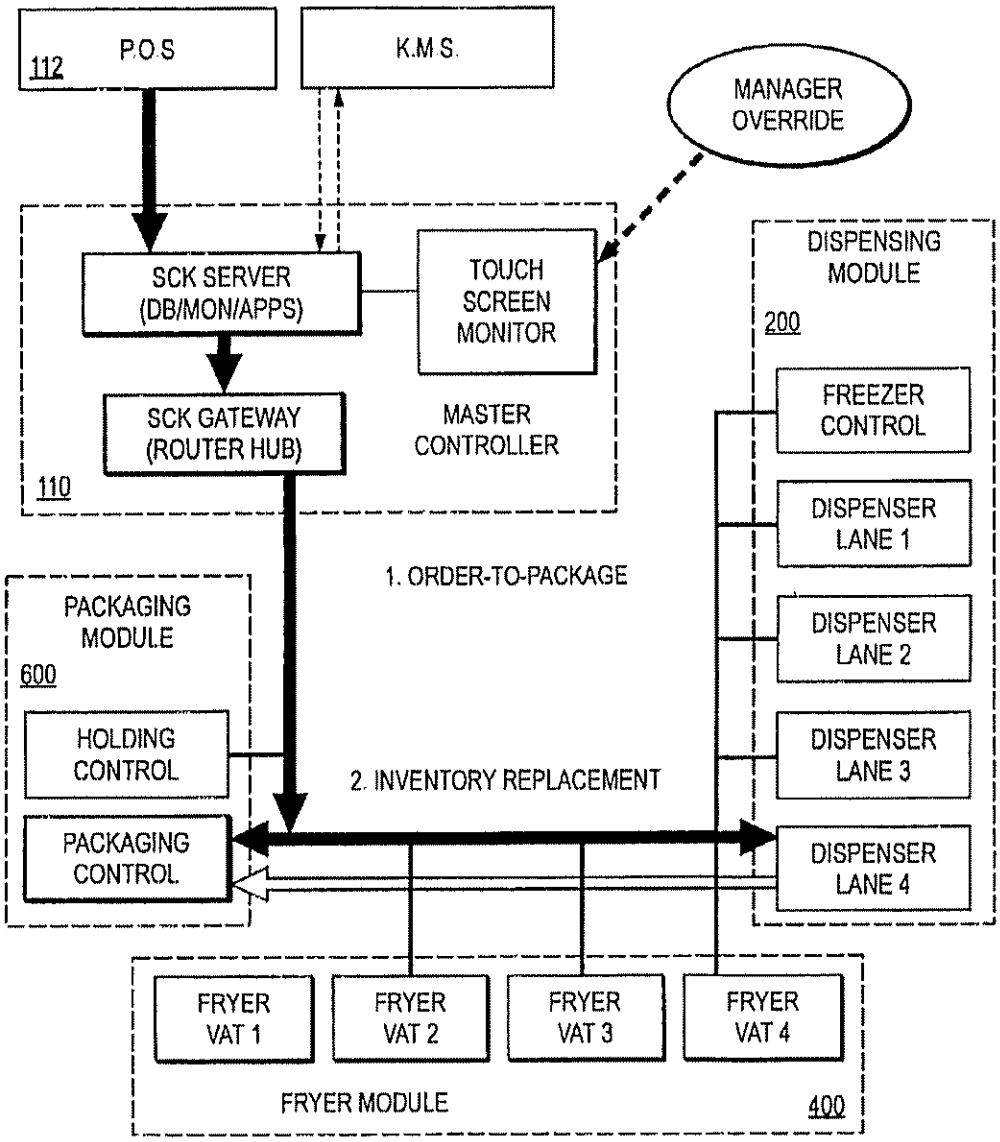

112
P.O.S
K.M.S.
MANAGER OVERRIDE
SCK SERVER (DB/MON/APPS)
TOUCH SCREEN MONITOR
SCK GATEWAY (ROUTER HUB)
MASTER CONTROLLER
110
DISPENSING MODULE
200
FREEZER CONTROL
DISPENSER LANE 1
DISPENSER LANE 2
DISPENSER LANE 3
DISPENSER LANE 4
1. ORDER-TO-PACKAGE
PACKAGING MODULE
600
HOLDING CONTROL
PACKAGING CONTROL
2. INVENTORY REPLACEMENT
FRYER VAT 1
FRYER VAT 2
FRYER VAT 3
FRYER VAT 4
FRYER MODULE
400

FIG. 71

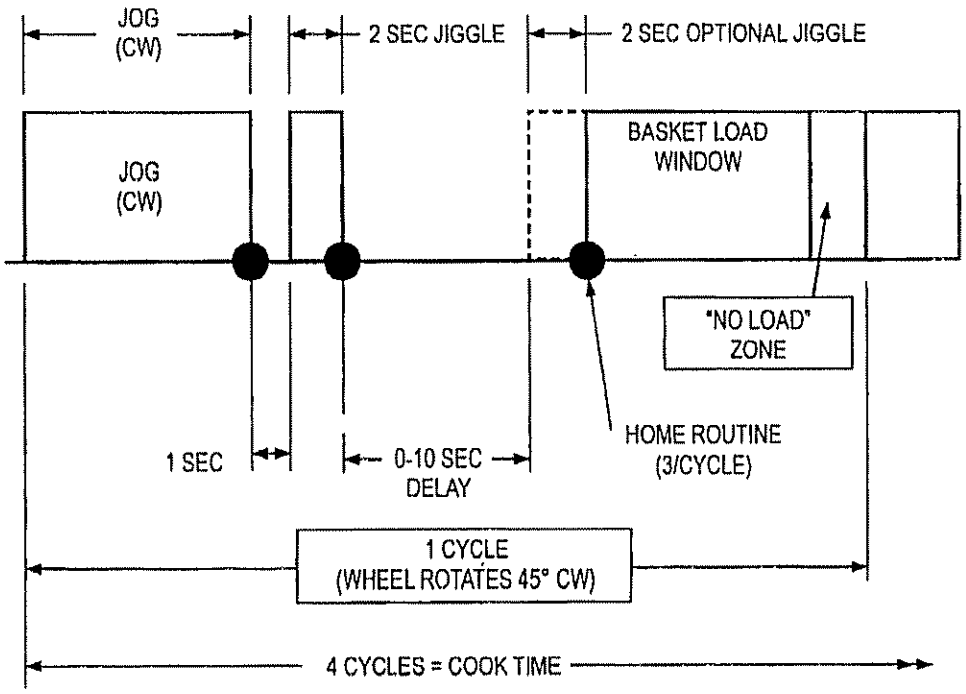

JOG
(CW)
2 SEC JIGGLE
2 SEC OPTIONAL JIGGLE
JOG
(CW)
BASKET LOAD
WINDOW
"NO LOAD"
ZONE
1 SEC
0-10 SEC
DELAY
HOME ROUTINE
(3/CYCLE)
1 CYCLE
(WHEEL ROTATES 45° CW)
4 CYCLES = COOK TIME

FIG. 72

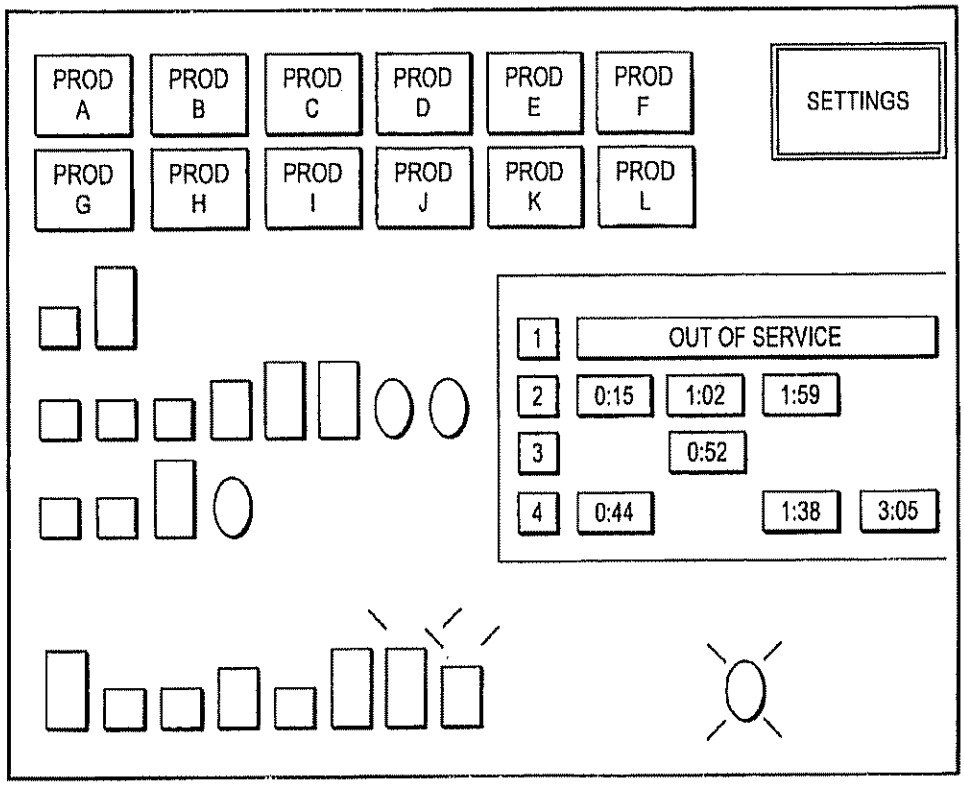
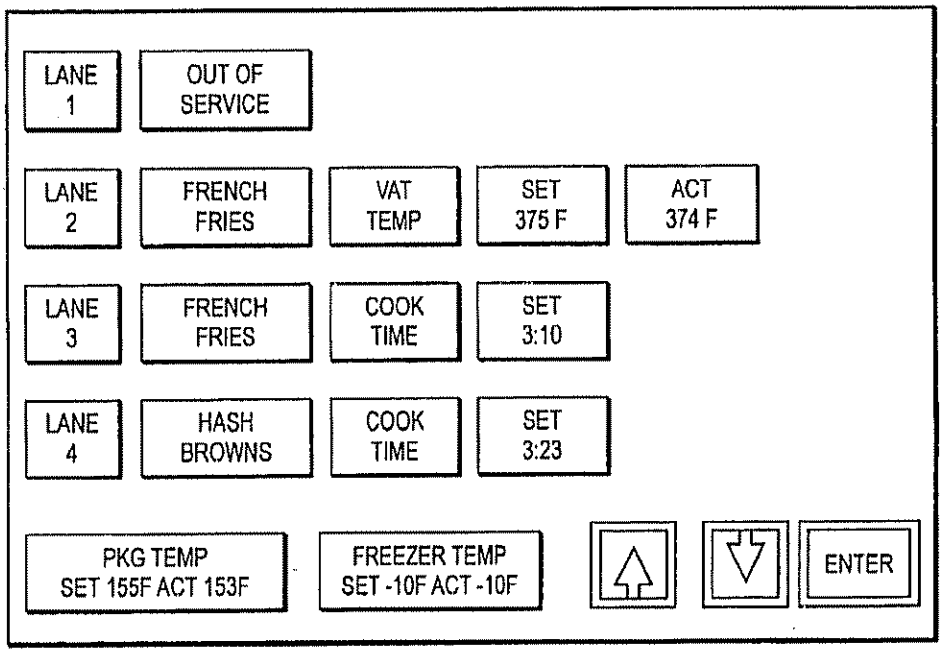

PROD A
PROD B
PROD C
PROD D
PROD E
PROD F
PROD G
PROD H
PROD I
PROD J
PROD K
PROD L
SETTINGS
1
OUT OF SERVICE
2
0:15
1:02
1:59
3
0:52
4
0:44
1:38
3:05

FIG. 73


LANE 1
OUT OF SERVICE
LANE 2
FRENCH FRIES
VAT TEMP
SET 375 F
ACT 374 F
LANE 3
FRENCH FRIES
COOK TIME
SET 3:10
LANE 4
HASH BROWNS
COOK TIME
SET 3:23
PKG TEMP SET 155F ACT 153F
FREEZER TEMP SET -10F ACT -10F
ENTER

AUTOMATED FOOD FRYING DEVICE AND METHOD

FIELD OF THE INVENTION

The invention relates to automated food processing. More particularly, the invention relates to automated food dispensing, frying and packaging into individual portion-sized containers such as at a quick-service type restaurant

BACKGROUND OF THE INVENTION

In restaurants, especially quick service (fast food) restaurants, fast, consistent, efficient and safe food preparation is essential for a successful operation The quality of the prepared food depends in large part on the consistency of food preparation The food must be cooked under correct conditions for the proper time

Consistency in food preparation can vary as a result of many factors. For example, people engaged in food preparation often must perform multiple tasks at frequencies that vary with time because of constantly varying customer demand throughout the day For example, lunchtime and dinnertime may be extremely busy while other periods may be relatively slow The product mix can vary from hour to hour and day to day As a result, the consistency and quality of food may vary Difficulties in proper scheduling of food production during peak and non-peak periods can cause customer delays and/or stale, wasted or unusable food

Food preparation can be labor intensive, and thus, the labor cost can be a large portion of the total cost of the prepared food An additional problem is that in sparsely populated and other areas where quick service restaurants are located, such as along interstate highways, for example, recruiting sufficient numbers of suitable employees is difficult

Quick service restaurants must be able to effectively meet a variable customer demand that is time dependent and not subject to precise prediction As a result, stores relying totally on human operators will at times be overstaffed and at other times be under-staffed Also, problems and potential problems can exist in restaurants where people directly prepare food. Health and safety concerns can also be present where food is prepared directly by people By reducing or minimizing human contact with food and food cooking equipment, health and safety concerns can also be reduced or minimized For example, in the frying of foods, some type of hot fluid, such as cooking oil or shortening must be utilized The cooking temperatures required can present a concern for health and safety

Although quick service restaurants have existed for many years and now number in the tens of thousands, such establishments utilize manual labor to prepare and process food While there have been various improvements in commercial equipment used for cooking food in quick service restaurants, such restaurants are believed to be substantially all manually operated and relatively labor intensive

Accordingly, a need exists for an automated, commercially suitable food dispensing, cooking and packaging device, system and method for fried foods that can be operated with a minimum of human intervention, control and maintenance More particularly, a need exists for an automated device, system and method that is capable of, without human labor, frying various food products in desired quantities, such as French fries, seasoning the cooked food and packaging the cooked food in individual portion-sized containers

SUMMARY OF THE INVENTION

In accordance with the present invention, an automated food processing system and method is provided The automated food processing system and method in accordance with the invention allows food to be dispensed, fried and packaged in a suitable container or alternatively dispensed to a food holding area for subsequent processing by a human operator

In accordance with one aspect of the present invention, an automated module system for dispensing, frying and packaging food into individual portion-sized containers is provided In one embodiment, any suitable automated dispensing device can be used In another embodiment, the system includes an automated dispensing module capable of dispensing a desired quantity of food to be fried, an automated fry module adjacent the dispensing module to receive and fry the quantity of food dispensed from the dispensing module and to produce and dispense a quantity of fried food and an automated packaging module adjacent the fry module to receive and package the fried food from the fry module into an individual portion-sized container

Advantageously, in one embodiment, the three modules are independent from each other and can be operated independently Plus, in one embodiment, any one of the modules can be deactivated and a human operator can manually perform the function of the deactivated module with manually operated equipment

In accordance with another aspect of the invention, optionally an automated seasoning device is present to apply seasoning to the food

Typically, the automated dispensing module in accordance with the invention in one embodiment is capable of dispensing one or more of uncooked or unheated French fries, chicken nuggets, hash browns, chicken patties and fish filets or similar types of food items to be cooked and/or heated

In accordance with another aspect of the invention, the automated dispensing module includes a freezer, a storage container located in the freezer for containing food to be dispensed, structure for dispensing a predetermined quantity of food from the storage container into a secondary or dump container, with the structure for dispensing and the secondary or dump container being located in the freezer, and structure for dispensing the quantity of food from the secondary or dump container to a location outside of the freezer

In accordance with another aspect of the present invention, the fry module of the automated modular system includes a fry vat for containing and heating cooking oil, at least one circular fry wheel having at least a generally circular perimeter in a plurality of compartments, each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel, which radial axis is disposed above the normal operating level of the frying oil or the cooking oil in the fry vat A drive mechanism is provided for rotating the fry wheel In one aspect of the invention, any suitable type of automated fry device can be utilized

In accordance with another aspect of the present invention, a control system is provided for causing the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation (such as about 2–10°, for example) to simulate shaking of a fry basket Such control can be accomplished electronically by devices known to those skilled in the art

In another embodiment, food is delivered from the fry module to a cooked food holding device, which can comprise a heated holding bin or bins

In accordance with still another aspect of the present invention, the automated packaging module includes a rotatable food dispensing member having an inlet location to receive a quantity of cooked food at a discharge location to discharge cooked food, the packaging module also including a food dispensing chute position to receive cooked food from the discharge location of the rotatable food dispenser, the food dispensing chute having a discharge location

In accordance with another embodiment of the invention, the automated modular system further includes a carton holding device for holding the individual portion-sized carton or container in position to receive food from the discharge location of the dispensing chute The packaging module may further include a rotatable food collecting member disposed to collect food from the discharge location of a dispensing chute that is not deposited into the individual portion-sized food container The so collected food may be subsequently deposited into the food dispensing chute for delivery to a container or alternatively to the rotatable food dispensing member or to a waste receptacle or chute

In accordance with another aspect of the invention, the automated packaging device includes a conveyor system for transporting filled individual portion-sized food containers from adjacent the filling location to a filled food container holding area, for subsequent pick-up by a human operator, for example In one embodiment, any suitable automated packaging device can be utilized

In accordance with another aspect of the present invention, an automated food carton-retrieving device is provided for retrieving and grasping individual portion-sized food containers The automated retrieving device comprises a moveable member for selectively grasping and releasing the food container In one embodiment, the retrieving device is capable of grasping and releasing an unerected food container on one side and the device further includes a second device for selectively grasping the unerected food container on the other side with structure for moving the retrieving device and the second device relatively apart when grasping the sides of the container to erect or partially erect the container

In another embodiment, an automated urging structure is provided for urging the container bottom upwardly relative to the sides of the container when the sides of the container are moved relatively apart

In accordance with another aspect of the invention, the automated modular system includes an electronic control system that receives current customer order information and the electronic control system causes the selection of a container from a plurality of different container sizes and further causes filling of food with the size of food container in response to a customer order In one aspect, the electronic control system can receive customer order information and controls the dispensing rate of food dispensed from the food dispensing module to the fry module which dispensing automatically determines the amount of food being fried without further intervention by the electronic control In one aspect, the control system can include a separate control system for each of the dispensing, fry and packaging systems or modules, each of which interface with a central control system, which in turn optionally interfaces with a POS (point-of-sale) system

In accordance with another aspect of the invention, the automated modular system is suitable for dispensing, frying and packaging French fries into individual portion-sized containers

In accordance with another aspect of the present invention, an automated method of dispensing, frying and packaging food into individual portion-sized containers is provided that includes dispensing a desired quantity portion of food to be fried from an automated dispensing module to an automated fry module and thereafter frying the portion of food dispensed from the dispensing module in the automated fry module adjacent the dispensing module to produce a quantity of fried food Thereafter, the quantity of fried food is dispensed from the fry module to a packaging module where the fried food dispensed from the fry module is packaged into individual portion-sized containers with an automated packaging module

In another aspect of the invention, the automated method further comprises seasoning the quantity of fried food with a seasoning device

In accordance with another aspect of the invention, the dispensing includes dispensing a predetermined quantity of food from the storage container into a secondary container located in a freezer and dispensing the quantity of food from the secondary container to a location outside of the freezer

In accordance with another aspect of the method of the present invention, the frying comprises a rotating fry wheel having at least a generally circular perimeter and a plurality of compartments, each compartment having an opening towards the perimeter, the food being contained in at least one of the compartments during the frying, the fry wheel being mounted for rotational movement relative to the radial axis of the fry wheel in a fry vat with the radial axis being disposed above a normal operating level of the cooking oil in the fry vat In accordance with this aspect of the invention, the automated method further includes containing a drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation to simulate shaking of a fry basket during frying

In accordance with another aspect of the invention, the packaging includes rotating a rotatable food dispensing member having an inlet location to receive a quantity of cooked food in a discharge location to discharge cooked food, the food dispensing member being rotated to dispense food into a food dispensing chute position to receive cooked food from the discharge location of the rotatable food dispenser and thereafter dispensing said food from the dispensing chute to a container to be filled

In accordance with another aspect of the invention, the method further includes holding an individual portion-sized carton or container positioned to receive food from the dispensing chute with an automated carton holding device

In accordance with still another aspect of the invention, the method further includes collecting food dispensed from the discharge location of the dispensing chute that is not deposited into the individual portion-sized food container with a rotatable food collecting member disposed to collect such not deposited food

In accordance with another aspect of the method, the method includes electronically coordinating the operation of the three modules or devices within an electronic control system In one embodiment, the method further includes electronically receiving current customer order information by the electronic control system which causes selection of a container from a plurality of different sized containers and filling the container with food of the ordered size of food container in response to a customer order by the packaging module In accordance with another aspect of the method, customer order information is electronically received and the dispensing rate of food dispensed from the food dis-

pensing module to the fry module is controlled, which dispensing automatically determines the amount food being fried without further intervention by the electronic control system

In accordance with another aspect of the present invention, an automated dispensing device for dispensing a quantity of food to be subsequently cooked is provided In one embodiment, the automated dispensing device includes a freezer or refrigerated compartment, a storage container located in the freezer for containing food to be dispensed, structure for dispensing a predetermined quantity of food from the storage container into a secondary or dump container, the structure for dispensing the predetermined quantity of food being located in the freezer, and structure is provided for dispensing the quantity of food from the secondary or dump container in the freezer to a location outside of the freezer

In one embodiment, the structure for dispensing a predetermined quantity of food includes a vibratory conveyor typically located in the freezer below the storage container The structure for dispensing may further include a device for determining or sensing the quantity of food that has been deposited in the secondary container and structure is provided for terminating the operation of the structure for dispensing when a predetermined quantity of food is sensed in the secondary container

In accordance with another aspect of the present invention, the automated dispensing device includes structure for dispensing a predetermined quantity of food that comprises a food magazine capable of dispensing individual pieces of food on a piece by piece basis In accordance with a more specific aspect of this embodiment, the magazine comprises dual rotatable spiral flights with the spiral flights having a spacing therebetween to allow placement of a food item, such as a chicken patty, for example, to be supported by both spiral flights

In accordance with another aspect of the invention, the magazine dispenser is suspended from a slide mechanism permitting removal of the magazine from the freezer or refrigerated compartment A plurality of the magazines can be located on a single slide mechanism An array of the magazines may be located in the freezer, such as a 3×5 array or a 3×4 array, for example

In one embodiment, a separate drive motor is associated with each food dispensing magazine for selectively rotating spiral flights of a magazine dispenser for dispensing a desired number of the food items The drive motor may also be located in the freezer

In accordance with another aspect of the invention, an automated method of dispensing a quantity of food to be cooked is provided The method includes storing food items in a storage container located in the freezer, dispensing food items from the storage container to a conveyor, conveying the food items on the conveyor to a secondary or dump container located in the freezer, monitoring the amount of food items delivered to the secondary container, terminating delivery of the food items to the secondary container when a desired amount of food items are determined to be present in the secondary container as determined by the monitoring, and dispensing the food items from the secondary container and out of the freezer by at least partially inverting the secondary container In accordance with another aspect of this embodiment, a freezer or refrigerated compartment is not utilized

In accordance with another aspect of the present invention, a device for the automated frying of foods is provided The device in one embodiment includes a fry vat for containing and heating cooking oil, at least one circular fry wheel having at least a generally circular perimeter and a plurality of compartments with each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel which radial axis is disposed above the normal operating level of the frying oil in the fry vat A drive mechanism is provided for rotating the fry wheel and a control system is included for causing the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of rotation (such as about 2–10°, for example) to simulate shaking of a fry basket Such control can be accomplished electronically by devices known to those skilled in the art

In accordance with another aspect of the present invention, the small amount of rotation is in the range of from about 2° to about 20° The back and forth rotation in one direction may be of a larger angle or amount of rotation than of the rotation in the other direction

In one embodiment, a control system is provided that causes periodic incremental rotation of the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and to move the compartments out of the cooking oil for subsequent discharge of the food from the compartment In one embodiment, the periodic incremental rotation is based on 360° divided by the number of compartments in the fry wheel

In accordance with another aspect of the present invention, a control system is provided for operating the drive mechanism to rotate the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and out of the cooking oil for subsequent discharge of the food from the compartment, wherein the control system adjusts the speed of rotation based on the level of cooking oil in the fry vat In one embodiment, the control system causes incremental periodic rotation of the fry wheel and the control system adjusts the period of time between incremental rotations based on the level of cooking oil sensed in the fry vat The period of time between incremental rotations can also be based on the temperature of the cooking oil in the fry vat

In accordance with another aspect of the invention, a curved baffle is provided that is disposed in the fry vat adjacent the axial periphery of the portion of the fry wheel that is disposed in the cooking oil for preventing food contained in one or more of the fry wheel compartments from falling out of the compartments

In accordance with another aspect of the present invention, an automated method of frying food in a fry vat having a heated cooking oil contained therein is provided The method includes placing food in a fry wheel compartment, each of the compartments having an opening towards the perimeter of the fry wheel, rotating the fry wheel so that the compartment containing the food travels submerged in the heated cooking oil and periodically rotating the fry wheel back and forth in a relatively small amount of rotation to simulate shaking of the fry basket while the food is submerged in the cooking oil In accordance with another aspect of the method of the present invention, the method comprises rotating the fry wheel in one direction to cause the food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and to move the food out of the cooking oil

for subsequent discharge of the food from the compartment, wherein the speed of said rotating is related to the level of cooking oil in the fry vat In accordance with this aspect of the present invention, the rotating may comprise incremental periodic rotation with the period of time between incremental periodic rotations being based on the level of cooking oil sensed in the fry vat The period of time between incremental periodic rotations may also be based on the temperature of the cooking oil in the fry vat

In accordance with another aspect of the present invention, an automated method of packaging cooked food, which may be food such as French fries, chicken nuggets and other types of food, in an individual portion-sized container is provided The method includes delivering a quantity of a cooked food to a rotatable dispensing member, rotating the dispensing member to cause the food items to fall from one or more compartments of the dispensing member into a food dispensing chute and thereafter dispensing the food from the chute and depositing the food into the individual portion-sized food container

In accordance with one aspect, the method may further include weighing the food in the chute before dispensing the food to the container

In accordance with another aspect of the invention, the method includes applying seasoning to the food and may further include applying the seasoning by using gravity to cause the seasoning to travel through a nozzle and onto the food

In accordance with another aspect of the invention, the method further includes shaking the individual portion-sized food container after the dispensing The shaking may be automated and can include back and forth movement of the container through an arc as desired, and may be in a generally vertical axis The arc may be a generally circular arc and the rotating back and forth may encompass an arc in the range of from about 3° to about 20° In addition, the container may be raised and lowered before, during or after the rotating to further simulate shaking or in connection with further container handling

In accordance with another aspect of the invention, when dispensing food from the chute to the individual portion-sized container, some of the dispensed food is not deposited into the individual portion-sized container and the method further includes collecting the not deposited food Typically, the not deposited food will be collected in a collection device that returns the not deposited food to the chute for subsequent dispensing In one embodiment, the collection member is rotatable and can be rotated to deposit the collected food to the chute This helps to ensure that the not deposited food is subsequently deposited into a container on a first-in, first-out or a generally first-in, first-out basis

In accordance with another aspect of the present invention, an automated method of packaging food, including food such as French fries, in an individual portion-sized container is provided that includes delivering a quantity of food to a food dispensing chute, selecting and holding with an automated device an individual portion-sized container of a desired size from a plurality of different sizes of individual portion-sized containers that can be selected and held by the automated device. The selected individual portion-sized container is moved by the automated device to a location for receiving food from the dispensing chute and food is dispensed from the chute and into the container The method may further include depositing the filled food container onto a conveyor by operation of the automated device and transporting the deposited container by the conveyor to a human operator food pickup location

In accordance with another aspect of the foregoing method, the individual portion-sized food container is unerected and the method further includes after the selecting, erecting the selected individual portion-sized food container by the automated device In one embodiment, the automated device includes a partial vacuum suction device for holding the individual portion-sized food container and the holding includes applying a partial vacuum through a suction device to the food container The food container can be released by reducing or eliminating the vacuum applied by the suction device to the food container sufficiently to cause the food container to be disengaged from the automated device

In accordance with another embodiment of the method, the filled food container is placed in an upright position on a transportable member or container-receiving receptacle which in one embodiment contains a single food container and is maintained in an upright position on the transportable member by cooperation of the recessed volume of the transportable member and the food container

In accordance with another aspect of the invention, the transporting is performed by a magnetic conveyor

In accordance with still another aspect of the invention, an automated device for packaging cooked food into a desired container, which may be an individual portion-sized food container is provided. The device includes a rotatable food dispensing member having an inlet location to receive a quantity of the cooked food and a discharge location to discharge the cooked food. A food dispensing chute is positioned to receive the cooked food from the discharge location of the rotatable food dispenser and the dispensing chute has a discharge location In one embodiment, the dispensing chute has a food holding area for holding a quantity of the cooked food deposited therein A suitable weighing device can be associated with the dispensing chute to weigh the food that is contained in the chute or in the holding area of the chute In one embodiment, the weighing device is a load cell

In accordance with another aspect of the invention, the automated device includes a food carton or container holding device for holding the food carton in position to receive food from the discharge location of the dispensing chute The carton holding device can include an axially rotatable generally vertically extending elongated first member and a second member that extends from the elongated member, the second member having a gripping member for gripping a food container, which may be an individual portion-sized food container In one embodiment, the gripping member comprises a suction cup A vacuum source may be supplied to the suction cup to create at least a partial vacuum, allowing the container to be held In one embodiment, the carton holding device is capable of moving the food container through an arc of about or of at least about 180° and in which the carton holding device is capable of moving the food container up and down

In accordance with another aspect of the present invention, the automated device comprises a conveyor system for transporting filled individual portion-sized food containers from adjacent the filling location to a filled container holding area The conveyor system may comprise in one embodiment a continuous loop raceway and a plurality of discrete moveable food container receptacles that are moveable along the raceway The conveyor system may include a continuous moveable loop having at least one magnetic element capable of magnetically attracting one of the moveable receptacles at a time for causing movement of

the receptacle corresponding to movement of the magnetic element A plurality of the magnetic elements may be spaced apart along the moveable loop

In one embodiment, structure is provided for preventing movement of the discrete receptacles when the structure for moving the discrete receptacles along the raceway is activated The structure for preventing movement can be a barrier that is disposed across the raceway In one embodiment, the barrier is selectively moveable and in another embodiment the barrier is fixed In one embodiment, the barrier prevents movement of the receptacles only for a receptacle that has a food carton or container disposed thereon. In this embodiment, the barrier may be located at a height that is above the top of the receptacles located on the conveyor system adjacent the barrier

In accordance with another aspect of the invention, an automated device is provided to retrieve and grasp a food container, which may be an individual portion-sized food or French fry container or carton The automated retrieving device includes a member for selectively grasping and releasing the food container and for moving the moveable member horizontally and linearly

In accordance with another aspect of the invention, a magazine is provided for holding a plurality of food containers in an unerected state

In accordance with another aspect of the invention, the automated device includes a retrieving device that is capable of grasping and releasing an unerected food container on one side and further includes a second device for selectively grasping the unerected food container on the other side A structure for moving the retrieving device and the second device relatively apart when grasping the sides of the container is provided The automated device may further include an automated urging means for urging the container bottom upwardly relative to the sides of the container when the retrieving device and the second device are moved relatively apart when grasping the container

In accordance with another aspect of the invention, the food dispensing member is a rotatable wheel having an open central area and an outer at least generally circular rim The rotatable wheel has a plurality of open compartments spaced apart about the circular rim that extend inwardly from the circular rim and open interiorly of the circular rim A baffle may be provided to prevent food contained in the one or more of the open compartments from falling out of the compartments when the wheel is rotated until the compartment is in position over the food dispensing chute The baffle may be curved to follow the curvature of the inner part of the wheel and may also be perforated The automated device may further include a rotatable food collecting member that is disposed to collect food dispensed from the discharge location of the dispensing chute which food is not deposited into a container held in position at the discharge location Typically, the collection member will have a discharge location to discharge collected food In one embodiment, the discharge location is the food dispensing chute The collecting member may be a rotatable food collecting wheel having an open central area and an outer circular rim having a plurality of open compartments spaced apart about the circular rim that extend inwardly from the circular rim and that are open towards the rim interior The rotatable food dispensing member and the rotatable food collecting member can be rotatable in one direction to discharge food at a discharge location and into a food dispensing chute and can be rotatable in an opposite direction to discharge the food at a second discharge location which may be to a waste chute The discharge to the waste chute feature can be activated, for example, when the food is held in the dispensing device for too long a period of time

The packaging device may also include an automated seasoning device for depositing a predetermined quantity of seasoning to food contained in the packaging device

In accordance with another aspect of the invention, the device for applying seasoning includes a seasoning delivery tube having an inlet and a discharge location A seasoning delivery head is positioned to deliver seasoning to the food to be seasoned with the head in communication with the outlet of the delivery tube and located below the inlet of the delivery tube Structure is provided for depositing a predetermined quantity of seasoning into the inlet of the delivery tube so that the quantity of seasoning falls by gravity through the delivery tube and into and through the seasoning head and onto the food to be seasoned Typically, the structure for depositing the predetermined quantity of seasoning will receive seasoning from a bulk hopper by gravity feed The quantity of seasoning to be dispensed can be determined volumetrically, for example

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a perspective view of an automated food processing system in accordance with the invention;

FIG 2 is a perspective view of an alternate embodiment of a food processing system in accordance with the present invention;

FIG 3 is a schematic view, partly in section, of the food processing system of FIG 1;

FIG 4 is a side elevation view of a portion of a bulk food dispensing device in accordance with the present invention;

FIG 4A is a side elevation view, partly in section, of an alternative embodiment for a portion of the dispensing device illustrated in FIG 4;

FIG 5 is a top plan view of a portion of the bulk food dispensing device in accordance with the present invention;

FIG 6 is a side elevation view, partly in section, of a bulk food dispensing device in accordance with the present invention and also illustrating a portion of a device for frying food in accordance with the present invention;

FIG 7 is a perspective view of a magazine-type dispenser that can form part of the food dispensing device of the present invention;

FIG 8 is a partial side elevation view of the magazine dispenser of FIG 7;

FIG 9 is a perspective view of a magazine-type dispenser array that can be utilized in the dispenser of the present invention;

FIG 10 is a fragmentary view of the device of FIG 9;

FIG 11 is a top plan view of a food frying device in accordance with the present invention;

FIG 12 is a front elevation view of the food frying device of FIG 11;

FIG 13 is a partial fragment sectional view along line 13—13 of FIG 11;

FIG 14 is a fragmentary sectional view of a portion of the food frying device of FIG 11;

FIG 15 is a sectional view along line 15—15 of FIG 14;

FIG 16 is a perspective view of a drive mechanism for the food frying device of FIG 11;

FIG 17 is a fry basket for use in the frying device of FIG 11;

FIG. 18 is a fragmentary sectional view along line 18—18 of FIG. 17;

FIG. 19 is an enlarged, fragmentary elevation sectional view of a portion of FIG. 13;

FIG. 20 is an alternate view along line 13—13 of FIG. 11;

FIG. 21 is a sectional view along line 21—21 of FIG. 20;

FIG. 22 is an enlarged fragmentary view of a portion of FIG. 21;

FIG. 23 is an alternate embodiment of a fry wheel in accordance with the present invention;

FIG. 24 is another alternate embodiment fry wheel in accordance with the present invention;

FIG. 25 is a front perspective view of a packaging device in accordance with the invention;

FIG. 26 is a rear perspective view of the device of FIG. 25;

FIG. 27 is a top plan view of the device of FIG. 25;

FIG. 28 is a side elevation view, partially in section and partially broken away of the packaging device of FIG. 25;

FIG. 29 is a front elevation view of the device of FIG. 25;

FIG. 30 is a front perspective view of a portion of an automated container handling system in accordance with the invention;

FIG. 31 is a top plan view of the container handling system of FIG. 30;

FIG. 32 is a side elevation view, partially broken away of the automated container handling system of FIG. 30;

FIG. 33 is a rear elevation view of the container handling system of FIG. 30;

FIG. 34 is a front perspective view of the container handling system of FIG. 30 shown in another operative position;

FIG. 35 is a top plan view of the container handling system of FIG. 34;

FIG. 36 is a side elevation view, partially broken away of the container handling system of FIG. 34;

FIG. 37 is a rear elevation view of the container handling system of FIG. 34;

FIG. 38 is a front elevation view of a portion of a container handling apparatus in accordance with the invention;

FIG. 39 is a front elevation view of another portion of the container handling apparatus of FIG. 34;

FIGS. 40–42 illustrate a front diagrammatic elevation view illustrating a portion of the container handling apparatus in accordance with the invention;

FIGS. 43–44 illustrate a side elevation view, partly in section, of a portion of the food packaging apparatus in accordance with the invention;

FIG. 45 is a top plan view of a food packaging device in accordance with the present invention;

FIG. 46 is a perspective view of a container-receiving receptacle in accordance with the present invention;

FIG. 47 is a top plan view of the device of FIG. 47;

FIG. 48 is a sectional view along line 48—48 of FIG. 47;

FIG. 49 is a cross-sectional view along line 49—49 of FIG. 47 and further including a portion of a conveyor system in accordance with the present invention;

FIG. 50 is a sectional view along line 50—50 of FIG. 49;

FIG. 51 is a front elevation view of a carton useful in accordance with the present invention;

FIG. 52 is a rear elevation view of a carton useful in accordance with the present invention;

FIG. 53 is a sectional view along line 53—53 of FIG. 52;

FIG. 54 is a bottom plan view of the container of FIG. 51;

FIG. 55 is a sectional view along line 55—55 of FIG. 57;

FIG. 56 is a perspective view showing use of the food container of FIG. 51;

FIG. 57 is a perspective view of a food container useful in accordance with the present invention;

FIG. 58 is an alternate embodiment perspective view of a container useful in accordance with the invention;

FIG. 59 is a development view of the carton of FIG. 51;

FIG. 60 is a side elevation view of the carton of FIG. 51;

FIG. 61 is a sectional view of a portion of the food packaging device of FIG. 25;

FIG. 62 is a sectional view of a portion of a food storage device in accordance with the present invention;

FIG. 63 is a sectional view of the food storage device of FIG. 62;

FIG. 64 is a side elevation view, partly in section, a hood system in accordance with the present invention;

FIG. 65 is a perspective view of an automated seasoning device in accordance with one aspect of the invention;

FIG. 66 is a side elevation view of the seasoning device of FIG. 65;

FIG. 67 is a front elevation view of the seasoning device of FIG. 65;

FIG. 68 is a top plan view of the seasoning device of FIG. 65;

FIG. 69 is a diagrammatic view of a control system in accordance with the present invention;

FIG. 70 is a diagrammatic view of a control system in accordance with the present invention;

FIG. 71 is a diagrammatic view of a frying cycle in accordance with the present invention;

FIG. 72 is a schematic illustration of a sample touch screen monitor useful in accordance with the invention; and

FIG. 73 depicts another touch screen layout in accordance with the present invention

DETAILED DESCRIPTION OF THE INVENTION

General

In accordance with the present invention, an automated food processing system and method is provided. The automated food processing system and method in accordance with the invention allows food to be dispensed, fried and packaged in a suitable container or alternatively dispensed to a food holding area for subsequent processing by a human operator.

Referring to the Figures generally and in particular to FIGS. 1 and 3, there is illustrated an automated food processing system 100 in accordance with the invention. Automated food processing system 100 includes a food dispensing device 200, a fry device 400 and a food packaging device 600. In accordance with one embodiment of the present invention, each of dispensing, fry and packaging devices 200, 400 and 600, respectively, can be constructed and are sometimes illustrated in "modular" construction or form. By "modular" construction or form it is meant that dispensing, fry and packaging devices 200, 400 and 600, respectively, can exist and be contained in separate cabinets, for example, and also operate independently of the other

devices Thus, if one of dispensing, fry and packaging devices **200**, **400** and **600**, respectively, are inoperative or are otherwise deactivated, the function of the deactivated or inoperative device can be performed manually For example, food to be fried could be manually dispensed in place of dispensing device **200** Alternatively, food to be fried could be fried in a conventional fry vat after being dispensed from dispensing device **200** in place of using fry device **400** and food that is dispensed and fried in dispensing and fry devices **200** and **400**, respectively, could, in turn, be packaged manually, for example

To facilitate such modular construction and use, each of dispensing, fry and packaging devices **200**, **400** and **600**, respectively, can be contained in a separate wheeled cabinet, **202**, **402** and **602**, respectively, as illustrated in FIG. **1** Alternatively, dispensing, fry and packaging devices **200**, **400** and **600**, respectively, could be mounted as a single unit or in a single cabinet or in "non-modular form," as desired, or more than one of such devices **200**, **400** and **600** could be so mounted or combined

A suitable control system for the dispensing, fry and packaging devices is also provided As will be described more completely hereafter, in one embodiment, the control system includes a central control system **110** that can interface with a point-of-sale system **112** The central control system will communicate with separate subcontrol systems **114**, **116** and **118**, one for each of the dispensing, fry and packaging devices **200**, **400** and **600**, respectively Alternatively, a single central control system (not shown) could be utilized in place of individual control systems for each of devices **200**, **400** and **600** Similarly, as another alternative, a single central control system could be utilized to control the overall operation of automated food processing system **100** as well as controlling the individual functions and aspects of dispensing, fry and packaging devices **200**, **400** and **600**

The basic operations of dispensing device **200**, fry device **400** and food packaging device **600** will now be briefly discussed and discussed in detail hereafter

Briefly, dispensing device **200** functions to dispense a quantity of food to be fried to fry device **400** In one aspect of the invention, any suitable food dispensing device can be utilized Dispensing device **200** can include a cabinet **202** to house the components of dispensing device **200** In one embodiment, cabinet **202** will be refrigerated, preferably below 32° F so that the food contents therein will remain frozen This allows the food stored in dispensing device **200** to remain therein for a long period of time, much longer than if the contents were merely refrigerated (above freezing) or merely at room temperature

In the illustrated embodiment, dispensing device **200** includes an uncooked bulk food dispensing container **204** Uncooked bulk food dispensing container **204** may be utilized for food such as French fries or chicken nuggets, for example Other types of food may also be contained in a dispenser such as uncooked bulk food dispensing container **204** Typically, those types of food would be in the form of relatively small pieces compared to relatively large food pieces such as chicken patties, for example.

For relatively large food pieces, a large food dispensing container is utilized In one embodiment, the large food dispensing container is in the form of a magazine food dispenser **206**

Food dispensed from a dispenser of dispensing device **200** is deposited on a conveyor **208** that, in turn, directs the deposited food to a secondary or dump container **210** for subsequent discharge from dispensing device **200**

In the illustrated embodiment, uncooked bulk food dispensing container **204**, magazine food dispenser **206**, conveyor **208** and secondary container **210** are contained in cabinet **202**, which is a refrigerated environment, preferably maintained below freezing (32° F or lower)

While any suitable conveyor can be utilized in one aspect, conveyor **208** is preferably a vibratory conveyor, vibrated by a suitable vibratory mechanism that vibrates a conveyor body **214** Conveyor body **214** may take the form of a suitably shaped tray, for example

By containing the foregoing components in a refrigerated and preferably frozen environment, consistency in food preparation and dispensing is achieved, thereby contributing to the overall efficient, effective and uniform performance of automated food processing system **100**

Secondary container **210** can be of a form as desired and includes suitable weighing mechanism **216** to permit a determination of the quantity of food contained in secondary container **210** Weighing mechanism **216** can be any suitable device to weigh the contents or otherwise determine the amount of food in secondary container **210** Weighing mechanism **216** may comprise a load cell or a mechanism for determining the volume of food deposited into secondary container **210**, for example In this manner, the amount of food that is charged to fry device **400** at a particular time can be determined In addition, weighing mechanism **216** can be operated during operation of conveyor **208** and the operation of conveyor **208** continued until a desired amount of food is deposited in secondary container **210** In this manner, a precise amount of food can be delivered to secondary container **210** thereby permitting consistency and uniformity in the portion of food that is delivered to fry device **400**. This is also important to ensure that a sufficient quantity of food is being cooked by automated food processing system **100**

Prior to activation of dumping mechanism **218**, discharge door **220** of cabinet **202** is opened by operation of a door opening device which can be any suitable device as desired and in the illustrated embodiment is a cylinder **222** attached to discharge door **220** and moveable up and down in the direction of arrow B Cabinet **202** is preferably insulated with a suitable insulating material **224** that is also provided in discharge door **220** The provision of a suitable insulating material is important, particularly since dispensing device **200** will typically be located proximate or adjacent fry device **400** that operates at a substantially elevated temperature, thereby typically generating substantial heat

In the illustrated embodiment, dispensing device **200** includes four dispensing lanes from which food is discharged from dispensing device **200** and to a suitable location such as fry device **400** After dispensing through discharge door **220**, cylinder **222** is activated to close discharge door **220** Similarly, dumping mechanism **218** of secondary container **210** is activated to return secondary container **210** to its upright position to receive more food

Fry device **400** includes a fry wheel **404**, a fry vat **406** for containing and heating a suitable cooking oil and a drive mechanism **408** for suitably rotating fry wheel **404** It is to be understood that in accordance with one aspect of the invention any suitable frying device can be utilized

In the illustrated embodiment of FIGS **3** and **11–16**, fry device **400** includes a plurality, in this case four, of separate fry wheels **404**, **410**, **412** and **414**, as well as four separate fry vats **416**, **406**, **420** and **418** and a separate drive mechanism **408** for each fry wheel, each dedicated to a particular one of fry wheels **404**, **410**, **412** and **414**

In one embodiment, a separate drive mechanism is provided for each of fry wheels **404**, **410**, **412** and **414** and can

be suitably located in cabinet **402**, preferably in a location that is above the level of cooking oil present in the associated one of fry vats **416**, **406**, **420** and **418**, respectively

The suitable rotation of each of fry wheels **404**, **410**, **412** and **414** can be as desired to direct food articles loaded therein down and through the fry vat until reaching the other side of the fry vat whereupon the food articles are discharged The rotation can be either continuous or a periodic incremental rotation For example, a suitable drive mechanism can be provided to periodically rotate fry wheel **410** in a desired rotational increment, which may be based on the number of compartments contained in fry wheel **410** In the illustrated embodiment of FIG **13**, for example, fry wheel **410** comprises eight food compartments **422**, **424**, **426**, **428**, **430**, **432**, **434**, and **436** Each of food compartments **422–436** is a perimeter food compartment and open to the perimeter or exterior of fry wheel **410** Each of fry wheels **404**, **412** and **414** can be similarly configured

As described in more detail hereafter, each of compartments **422–436** is formed from a perforated curved compartment forming member **510**

In the rotation of fry wheel **410**, a periodic incremental rotation can be based upon 360° divided by the number of compartments Thus, for example, in the illustrated embodiment of FIG **13**, each periodic rotation would consist of a rotation of 360° divided by eight compartments or a periodic rotation increment of 45° Thus, as illustrated in FIG **13**, the food contained, in this case French fries, in compartments **424–430** would remain in cooking oil **454** contained in fry vat **406** for all or part of four incremental rotations, after which the food would be discharged from fry wheel **410** in the next incremental rotation thereof. For example, as illustrated in FIG **13**, compartment **422** is ready to receive a charge of food to be fried, compartment **424** has a charge of food that has been just immersed in cooking oil **454** Cooking oil **454** is at a level H as illustrated in FIG **13**, which is dependent upon the amount of food contained in compartments **422–436** that are submerged in cooking oil **454**

Similarly, compartment **426** has food contained therein that has gone through two incremental 45° rotations of fry wheel **410**, compartment **428** has food contained therein that has undergone three incremental rotations and food compartment **430** has food contained therein that has undergone four incremental rotations of fry wheel **410** and compartment **432**, which is now empty, has discharged the food contained therein upon the last incremental rotation of fry wheel **410** Thus, upon the next incremental rotation of fry wheel **410**, which is in the clockwise direction as shown by arrow B of FIG **13**, the food contained in food compartment **430**, which in this case is a quantity of French fries **455**, will be discharged from compartment **430** to the food packaging device which is hereafter briefly described

Upon discharge of food, which in this case is a quantity of French fries from one of compartments **422–436** of a fry wheel, such as fry wheel **410** as illustrated in FIG **3**, the food is deposited onto an inlet chute **604** of food packaging device **600**.

From inlet chute **604**, the food from inlet chute **604** received from fry wheel **410** is deposited into rotatable food dispensing member **606** Typically, rotatable food dispensing member **606** will be compartmented into a plurality of compartments that are arrayed along the periphery of rotatable food dispensing member **606**

Rotatable food dispensing member **606** has a discharge location to discharge the food deposited therein The discharge location is generally located towards an upper portion of rotatable food dispensing member **606** A food dispensing chute mechanism **608** is positioned to receive cooked food from the discharge location of rotatable food dispensing member **606** In a preferred embodiment, food dispensing chute mechanism **608** incorporates a device for weighing or otherwise determining the quantity of food that has been deposited into food dispensing chute mechanism **608** This ensures that when food is dispensed from food dispensing chute mechanism **608** a minimum quantity of food will be dispensed, thereby ensuring that a container **611** or other package that is to receive the food from mechanism **608** will receive a desired charge

Food packaging device **600** preferably also includes a suitable automated container handling system **610** Automated container handling system **610** is capable of, in a preferred embodiment, selecting container **611** of a desired size, retrieving and grasping container **611**, erecting unerected container **611** into an erected form and holding the erected container **611** in position to receive food dispensed from food dispensing chute mechanism **608**.

After food container **611** receives food from food dispensing chute mechanism **608**, automated container handling system **610** is capable of moving container **611** having food deposited therein to a container receiving receptacle **612** which receptacle **612** can be transported via a conveyor system **614** to a desired location for subsequent pickup of container **611** having food contained therein by a human operator, for example

Preferably, a food overflow collection member is provided to collect any food dispensed by food dispensing chute mechanism **608** that is not deposited into container **611** In one embodiment, the overflow food collection device is a rotatable food collection member **613** Overflow food collection member **613** functions to collect food dispensed by food dispensing chute mechanism **608** that is not received in container **611** and to recycle food collected by overflow food collection member **613** into food dispensing chute mechanism **608** for subsequent dispensing to a container in a first-in, first-out manner so that overflow food is promptly recycled to dispensing chute **608** for dispensing to a container

Preferably, food packaging device **600** is configured to include a provision by which food contained in dispensing device **600** is routed to waste where it is not desired to dispense such food into a food container Such a condition could arise, for example, if food is held for too long a period in food packaging device **600** This function may be accomplished, for example, by providing a waste discharge location which can be in the form of a waste chute **615** to which food from rotatable food dispensing member **606** and overflow food collection member **613** can be directed In one embodiment, chute mechanism **608** is lowered and member **606** is rotated to dispense food to chute mechanism **608**, which in turn dispenses into member **613** Member **613** is rotated counterclockwise to deliver food to waste chute **615** This process can be continued until all of the food in device **600** is so emptied, if desired

Preferably, a suitable structure for applying a desired quantity of seasoning to food contained in food packaging device **600** is provided. In the embodiment illustrated in FIG **3**, a food seasoning device **616** is provided Food seasoning device **616** can be any suitable seasoning device as desired In one embodiment, food seasoning device **616** dispenses a desired quantity of seasoning from a bulk storage container through a delivery tube and onto food located in rotatable food dispensing member **606**

Preferably, and in the embodiment illustrated in FIG **3**, a food seasoning device **616** is provided that directs a desired

quantity of seasoning onto food that is contained in a bottom portion of rotatable food dispensing member **606** and inlet chute **604** via a seasoning dispensing head **618**

Preferably, conveyor system **614** is composed of a raceway **620** that is an endless loop around the periphery of the top surface of cabinet **602** of food packaging device **600**, which in one embodiment can be a modular, wheeled cabinet Conveyor system **614** causes container receiving receptacle **612** to travel around raceway **620** to a food container pickup location **622** where a human operator can pickup food containers having food therein Preferably, conveyor system **614** includes structure for stopping movement of a container/receiving receptacle **612** at a predetermined location when carrying a food container, such as at food container pick up location **622** Such structure in one embodiment may comprise a gate structure **928** or **928'** of FIG **45** and FIGS **25–27**, respectively, that extends across at least a portion of raceway **620** in the vicinity of the predetermined location Any suitable type of barrier structure can be utilized to prevent the desired movement Most preferably, gate structure **928** or **928'** will be located at a height that is above the top of the receptacle when located on conveyor system **614** so that movement of container/receiving receptacle **612** is prevented or stopped only for a receptacle **612** that has a food container **611** disposed thereon Note that the pickup location can be configured as desired and slightly different configurations **622** and **622'** are shown in FIG **45** and FIGS **25–27**, respectively

Referring to FIG **2**, there is illustrated an alternate embodiment of an automated food processing system **101** in accordance with the invention Automated food processing system **101** includes a food dispensing device **201** which is similar to food dispensing device **200**, previously briefly described, where like reference numerals represent like elements. Food dispensing device **201** includes fewer uncooked bulk food dispensing containers **204** and additional magazine food dispensers that are similar to magazine food dispenser **206**, previously referred to Otherwise, dispensing device **201** is similar to dispensing device **200** previously described

Automated food processing system **101** also includes fry device **400**, which has been described

One primary distinction between automated food processing system **100** and automated food processing system **101** is that automated food processing system **101** does not include an automated packaging device such as automated packaging device **600** In place of food packaging device **600**, a food storage device **635** is provided Food storage device **635** allows food cooked by food frying device **400** to be stored in a heated environment for subsequent manual processing As configured in FIG **2**, food storage device **635** includes separate heated product receiving receptacles **637**, **639**, **641** and **643** Each receptacle **637**, **639**, **641** and **643** is dedicated to receiving food from a respective one of fry wheels **410**, **412**, **414** and **404**, respectively In addition, each receptacle **637–643** can have placed therein a suitable container to receive food, such as handled trays **645**, **647**, **649** and **651**

As illustrated in FIG **2**, a food item F is being discharged from fry wheel **414** down a chute **653** and into handled tray **649** contained within heated receptacle **641** Food item F can be stored therein for a period of time until it is ready for subsequent processing

Food Dispensing Device

Referring to the Figures generally and in particular to FIGS **1–10**, there is illustrated various embodiments of food dispensing devices and portions thereof in accordance with the invention

In one embodiment, food dispensing device **200** is illustrated or partially illustrated in FIGS **1** and **3–8** Food dispensing device **200** includes a cabinet **202**, bulk uncooked food dispensing containers **204**, **205** and **207**, magazine food dispenser **206**, **209**, **211** and **213**, and a suitable conveyor system for each lane **234**, **236**, **238** and **240** of food dispensing device **200** Any suitable number of magazine dispensers can be used for a particular lane, such as one, two, three, four, five or more, and the illustrated embodiment of four is merely an example As configured in FIG **1**, for example, lane **234** receives material from bulk hopper **204**, lane **236** receives food material from bulk hopper **205**, lane **238** receives food material from bulk hopper **207** and lane **240** receives dispensed food from magazine food dispensers **206**, **209**, **211** and **213** as will be described hereinafter in greater detail, particularly with respect to food dispensing device **201** of FIG **2**, for example.

Each lane **234**, **236**, **238** and **240** dispenses food that is subsequently directed to fry wheels **410**, **412**, **414** and **404**, respectively

The components of lane **238** will now be described in detail and it is to be understood that the components of lanes **234** and **236** are similar Lane **238** includes uncooked bulk food dispensing container **207** and a food handling system **242** which in this embodiment is identical for each lane **234**, **236**, **238** and **240** as well as for each lane of food dispensing device **201** It should be noted that food handling system **242**, as for example, illustrated in FIGS. **3–6** is depicted with respect to lane **240** and that food handling system **242** is the same for each lane **234**, **236**, **238** and **240**

Food handling system **242** includes conveyor system **208**, secondary container **210**, weighing mechanism **216** and dumping mechanism **218** Conveyor system **208** includes vibratory mechanism **212** and conveyor body **214**

Uncooked bulk food dispensing container **204** can be of a shape and dimension generally as desired. Preferably, uncooked bulk food dispensing container **204** has an upper opening to permit a supply of food to be placed in uncooked bulk food dispensing container **204** Upper opening **244** as illustrated is located in an upper rear portion of uncooked bulk food dispensing container **204** and can be conveniently accessed via a rear door **246** of cabinet **202** Rear door **246** preferably is insulated with suitable insulation material **224**

Uncooked bulk food dispensing container **204** is composed of a pair of opposed upper sidewalls **248**, a pair of generally opposed lower sidewalls **250** and front and rear walls **252** and **254**, respectively, which connect together upper sidewalls **248** and **250** to provide uncooked bulk food dispensing container **204** Front sidewall **252** includes a lower portion **252'** that extends inwardly from top to bottom to further facilitate discharge of food contained in uncooked bulk food dispensing container **204** Preferably, lower generally opposed sidewalls **250** are slightly indented from top to bottom to facilitate the discharge of food that may be contained therein

Uncooked bulk food dispensing container **204** includes a bottom opening **256** that permits the discharge of food contained therein Bottom opening **256** can be configured as desired and in the illustrated embodiment the entire bottom of uncooked bulk food dispensing container **204** is open In the illustrated embodiment, uncooked bulk food dispensing container **204** is particularly suited for use with food such as French fries and chicken nuggets as well as other types of food of relatively small size

Uncooked bulk food dispensing container **204** is suitably mounted within cabinet **202** While a suitable mounting

structure can be utilized, it is preferred to utilize a structure that will minimize heat transfer from the exterior and through cabinet **202** to uncooked bulk food dispensing container **204**, particularly where cabinet **202** is refrigerated, especially where temperatures below freezing are utilized In that regard, front mounting bracket **258** and rear mounting bracket **260** each are configured to minimize heat transfer from cabinet **202** to uncooked bulk food dispensing container **204** In that regard, front mounting bracket **258** and rear mounting bracket **260** include openings, **258'** and **260'**, respectively, to minimize such heat transfer and to maximize airflow around the containers **204, 205, 207** and dispensers **206, 209, 211** and **213** Similarly, materials of low thermal conductivity can also be utilized, if desired, for brackets **258** and **260** Generally, to minimize heat transfer and to maximize airflow, the surface area contact and cross-sectional area of mounting brackets **258** and **260** should be minimized to reduce heat transfer and "hot spots" on uncooked bulk food dispensing container **204**

As illustrated in FIGS. **3** and **4**, for example, food contained in uncooked bulk food dispensing container **204** passes through bottom opening **256** and onto conveyor body **214** which in the illustrated embodiment is a suitably dimensioned pan Conveyor body **214** is suitably mounted to vibratory mechanism **212** to effect vibration of conveyor body **214** as well as food contained therein and food contained in uncooked bulk food dispensing container **204**, and in particular the lower portion of container **204** This vibration facilitates the discharge of food from uncooked bulk food dispensing container **204** and causes food contained in conveyor body **214** to travel in the direction of arrow G Any suitable conveyor system can be used in accordance with one aspect of the invention

A preferred type of vibratory mechanism is available from FMC Technologies, Inc of Chicago, Ill marketed under the model F-010-B and DF-010-B Vibratory mechanism **212** is preferably an electromagnetic vibrating mechanism Vibratory mechanism **212** in one embodiment produces a vibrating stroke at the surface of conveyor body **214** The stroke results from the action of an electromagnet that pulls conveyor body **214** sharply down and backward and then allows it to spring up and forward Typical vibratory mechanisms of this type run at about 3,600 vibrations/minute at 60 Hz power The power of the vibrating stroke can be controlled by a suitable drive module as is known in the art In one embodiment, vibratory mechanism **212** can be operated at about 85% of full power during filling of secondary container **210** with food For the first part of a fill cycle of secondary container **210**, vibratory mechanism **212** can be run continuously, then pulsed by turning its power on and off periodically so that vibratory mechanism **212** operates about 50% of the time to finish filling secondary container **210** with a desired quantity of food, thereby providing better control on the last part of the food charged to secondary container **210**

Food dispensing device **200** preferably includes a suitable mechanism to determine the weight or volume of a charge of food delivered by conveyor system **208** to secondary container **210** The amount may be determined either by weight or volume, for example. In the illustrated embodiment, weighing mechanism **216** is operatively interfaced with secondary container **210** to provide an indication of the weight of food contained in secondary container **210** The weight sensed in secondary container **210** by weighing mechanism **216** is communicated with control system **114** of food dispensing device **200** Control system **114** monitors and controls the operative functions of food dispensing device **200** as hereinafter described in greater detail

Optionally, a level sensor can be employed in uncooked bulk food dispensing container **204** to provide an indication of the amount of food stored therein that is available for dispensing Any suitable level indicator known in the art can be utilized in accordance with the invention such as photoelectric, weight, turning fork and others, for example

Secondary container **210** can be considered as a dump container and as associated therewith, dumping mechanism **218** for rotating secondary container **210** through an arc as indicated by arrow B sufficiently to dump the contents of secondary container **210** Any suitable dumping mechanism can be utilized Illustrated dumping mechanism **218** includes a dump cylinder **264** that is secured to a base **266** Dump cylinder **264** can selectively rotate a drive gear or wheel **268** that, in turn, is operatively associated with a follower gear or wheel **270** to cause rotation of follower gear or wheel **270** Secondary container **210** is rigidly secured to follower gear or wheel **270** so that when follower gear or wheel **270** is rotated by drive gear or wheel **268** secondary container **210** is rotated through an arc that causes secondary container **210** to rotate forward to a dumping position as illustrated in phantom lines in FIG **3** indicated by reference numeral **210'** Such movement is caused by extension of dump cylinder **264** Similarly, retraction of dump cylinder **264** moves secondary container **210** from the dump position indicated by reference numeral **210'** to the upright position indicated by reference numeral **210** in FIG **3** where secondary container **210** is ready to receive a charge of food from conveyor system **208**, which in the illustrated embodiment the food is French fries FF

An alternative embodiment for secondary container **210** is illustrated in FIG **4A** Secondary container **210'** is composed of a pair of opposed spaced apart sidewalls **211** (only one sidewall **211** is illustrated and is depicted in a half-moon configuration) and a pair of sidewalls **213*a*** and **213*b***, oriented in a V-shaped relationship when container **210'** is configured to receive food from conveyor body **214** Sidewall **213*a*** is mounted for pivotal movement about an apex identified by sidewalls **213*a*** and **213*b*** Such movement is accomplished by a drive mechanism similar to cylinder **264**, drive gear **268** and driven gear **270**, which in this embodiment are cylinder **264'**, drive gear **268'** and driven gear **270'**, which gear **270'** is attached to sidewall **213*a*** When cylinder **264'** is extended, sidewall **213*a*** is caused to pivot downwardly as indicated by arrow AA to the position of sidewall **213*a*** shown in phantom, thereby causing the contents (French fries FF) of container **210'** to be dumped Sidewalls **211** act as sidewall guides for sidewalls **213*a*** and **213*b*** when sidewall **213*a*** is in a lowered position, in which case sidewalls **213*a*** and **213*b*** act as a chute or slide

Control system **262** coordinates the operation of the various functions of food dispensing device **200** For example, when food dispensing device **200** is ready to dump a charge of food from secondary container **210** out of food dispensing device **200**, control system **262** activates cylinder **222** to open discharge door **220** thereby permitting the food charge in secondary container **210** to be dumped by dumping mechanism **218** through open discharge door **220** After dumping of the food charge is completed, control system **114** causes dump cylinder **264** to be retracted thereby returning secondary container **210** to a position ready to accept a further charge of food from conveyor system **208** Cylinder **222** has one end rigidly secured to cabinet **202** or some other suitable location and the other end of cylinder **222** is attached to discharge door **220** Typically, discharge door **220** will have a suitable guide mechanism, which may be tracks, slots or other suitable apparatus to guide discharge

door 220 to its open and closed positions Cylinder 222 is operable to move door 220 up and down as indicated by arrow B in FIG 6 to thereby open and close discharge door 220 as desired In the illustrated embodiment, discharge door 220 extends across all four dispensing lanes 226, 228, 230 and 232 If desired, a separate discharge door could be provided for each of dispensing lanes 226, 228, 230 and 232 In addition, control system 262 causes activation of cylinder 222 to close discharge door 220 to prevent heat from entering into cavity 272 of food dispensing device 200 in which the food and various dispensing mechanisms are contained as illustrated in FIGS 3 and 6, for example

Food dispensing device 200 can contain suitable refrigeration components 274 such as within a lower portion of cabinet 202 as shown schematically in FIG. 1 In accordance with the preferred embodiment of food dispensing device 200, refrigeration components 274 provide sufficient cooling to provide a below freezing temperature environment in cavity 272 Alternatively, suitable refrigeration components can be provided exteriorly of cabinet 202 and even at a remote location as desired In addition, a storage compartment 276 and a storage compartment door 278 may also be provided in cabinet 202 An upper side access door may also be provided to permit operator access to the interior of cavity 272 where uncooked bulk food dispensing containers 204 and/or magazine food dispensers 206 and/or 209, 211 and 213 are located.

Referring to FIGS 2 and 7–10, there is illustrated another embodiment of food dispensing device 201 in accordance with the present invention

Food dispensing device 201 has many similarities to food dispensing device 200 previously described where like reference numerals represent like elements Thus, food dispensing device 201 includes cabinet 202, four product dispensing lanes 226, 228, 230 and 232 with each such lane incorporating conveyor system 208, secondary container 210, vibratory mechanism 212, conveyor body 214, weighing mechanism 216, dumping mechanism 218, discharge door 220, cylinder 222, insulating material 224, food handling system 242, upper opening 244, rear door 246, uncooked bulk food dispensing container 204 which is associated with product dispensing lane 234, a dump cylinder 264 for each product dispensing lane, cavity 272, refrigeration components 274, storage compartment 276 and a storage compartment door 278 Product dispensing lanes 228, 230 and 232 each have associated therewith a plurality of magazine food dispensers 280–308 arrayed to provide in the embodiment illustrated in FIG. 9 five magazine food dispensers per product dispensing lane in which there are three product dispensing lanes serviced by the foregoing magazine food dispensers. Consequently, magazine food dispensers are configured in a three-by-five array and are suspended from a magazine food dispenser support 310 as shown in FIG 9 Each row of three magazine food dispensers depends from magazine food dispenser support 310 via a slide assembly 312 Slide assembly 312 is similar to a drawer slide including a pair of first and second elongated telescoping left and right slides 314 and 316, respectively. Suitable upper rollers 318 are mounted to magazine food dispenser support 310 and lower rollers 320 depend from magazine food dispensers 280–308 for traversing left and right elongated telescoping slides 314 and 316

Suitable mounting brackets 322 are provided which depend upwardly from magazine food dispenser support 310 for mounting to cabinet 202

In addition, suitable mounting brackets 324 are provided which depend downwardly from magazine food dispenser support 310 for mounting slide assembly 312 thereto allowing magazine food dispensers 280–308 to depend therefrom

Magazine food dispenser support 310 has a series of holes 326 and 328 therein Holes 326 can be provided to allow increased airflow and cooling. Holes 328 can also be provided to provide increased airflow and cooling for magazine food dispensers 280–308

Each of magazine food dispensers 280–308 and 206, 209, 211 and 213 briefly discussed with respect to food dispensing device 200 are similar in construction Magazine food dispenser 206 will be discussed with respect to FIGS 7 and 8 and it is to be understood that the other magazine food dispensers are of similar construction.

Magazine food dispenser 206 includes a body or housing 330 that includes sidewalls 332 and 334, front walls 336 and 338 and corresponding rear walls (not shown) and can be attached in a removable manner if desired, including in a snap-on arrangement to facilitate cleaning Magazine food dispenser 206 also includes a top member or cover 340 having mounted thereover a drive mechanism 342. Drive mechanism 342 includes a drive gear or wheel 344 and a driven wheel or gear 346 Depending from each of drive wheel or gear 344 and driven wheel or gear 346 is a spiral flight that is vertically or generally vertically oriented relative to the longitudinal axis of spiral flights 348 and 350 If desired, a single spiral flight dispenser (not shown) could also be utilized

Body 330 of magazine food dispenser 206 can include substantial open portions such as front open portion 352 and a corresponding rear open portion (not shown) Such open portions may have a cover or access door thereover (not shown) Such open portions can be desirable to permit airflow through magazine food dispenser 206 since generally such dispenser will be contained in a refrigerated environment and such openings help ensure that food contained therein remains frozen or chilled as desired A vertical divider (not shown) can be provided between spiral flights 348 and 350 if desired

A plurality of generally vertically disposed and spaced apart rods 354, 356 and 358 may be provided at the front of magazine food dispenser 206 adjacent spiral flights 348 and 350 and similar rods can be provided at the back of magazine food dispenser 206 Rods 354, 356 and 358 prevent food pieces from falling out of spiral flights 348 and 350 and to maintain spiral flights 348 and 350 in a vertical orientation

Magazine food dispenser 206 has an open bottom 360 through which food pieces can be dispensed during operation

During operation, drive wheel 344 can be driven by a suitable electric motor, such as an electric motor 362, 364 and 366 shown with respect to magazine food dispensers 280, 282 and 284 in FIG 9 Alternatively, other drive devices could be used, including, for example, a rotary air or hydraulic cylinder Rotation of drive wheel 344 in a clockwise direction causes driven wheel 346 to rotate in a counterclockwise direction by virtue of the intermeshing or contact between drive wheel or gear 344 and driven wheel or gear 346 Such rotation causes corresponding rotation of spiral flights 348 and 350, respectively Food contained by spiral flights 348 and/or 350 is moved downwardly by virtue of such rotation When such food reaches the bottom of spiral flights 348 and/or 350, respectively, such food is discharged from magazine food dispenser 206 through open bottom 360 and onto conveyor system 208 for handling as previously described A single motor could be used to drive a plurality of dispensers 280, 282 and 284, etc through a suitable drive mechanism (not shown)

As shown in FIG 8, pieces of food can be contained by magazine food dispenser 206 in two different ways For example, individual pieces of food may each be contained by a single elongated spiral flight 348 or 350 as shown with respect to food pieces F1 and F2, respectively Food pieces F1 and F2 can be any type of desired food and may be a food item such as a hash brown, an individual portion pie, rectangular food patty, or other type of food as desired Chicken nuggets and other food can also be dispensed with the bulk dispenser previously described Larger items of food can span across portions of both elongated spiral flights 348 and 350 as illustrated with respect to food item F3, which may be a larger food item, such as a chicken patty, or other type of food article as desired Spiral flights 348 and 350 can be of a desired radial diameter so that the food piece or pieces that are to be contained and dispensed in magazine food dispenser 206 can be accommodated as illustrated in FIG 8 Each spiral can contain a food piece so that as illustrated in FIG 7, the illustrated spirals of spiral flights 348 and 350 could each accommodate twelve food pieces such as food pieces F1 or F2 for a total of twenty-four food pieces or twelve food pieces such as food piece F3 of FIG 8 As will be appreciated, spiral flights having a greater or lesser number of flights can be used if desired to hold a greater or lesser number of food pieces, respectively

A suitable home position sensor 362' can be utilized to indicate a home or start position of each of spiral flights 348 and 350 As illustrated in FIG 7, a pair of position indicating sensors 362' and 364' are utilized and mounted on drive wheel 344 180° apart for more precise locating of the position of spiral flights 348 and 350 Sensors 362' and 364' can be proximity sensors that align with corresponding sensor pickups on the respective drive gear or motor for magazine food dispenser 206 (not shown)

Preferably, spiral flights 348 and 350 are offset by one rotation so that a single food item such as food item F1 or F2 in FIG. 8 will be dispensed from one of either spiral flight 348 or 350 for each one-half rotation of spiral flights 348 and 350

Preferably, food dispensing device 200 and food dispensing device 201 are constructed in modular form, an example of which is illustrated in FIGS 1 and 2, respectively Wheels 368 are provided to permit cabinets 202, 402 and 602 to be suitably transported across a relatively flat surface, such as a restaurant work area floor

Food Frying Device

Referring to the Figures generally, and in particular to FIGS 1–2 and 11–24, there is illustrated fry device 400 and various components and alternative components thereof in accordance with the invention

In one embodiment, fry device 400 includes cabinet 402, four fry wheels 404, 410, 412 and 414, four fry vats 406, 416, 418 and 420, four drive mechanisms 408, one for each of fry wheels 404, 410, 412 and 414 Each fry vat 406, 416, 418 and 420 is dimensioned to contain a desired volume of a suitable cooking oil Each fry vat 406, 416, 418 and 420 is dedicated to one of fry wheels 404, 410, 412 and 414, respectively

In operation in the preferred embodiment, fry device 400 is positioned to receive the food dispensed from a food dispensing device, such as food dispensing device 200 and food dispensing device 201 Consequently, it is advantageous to position fry device 400 adjacent food dispensing device 200 or 201 as illustrated in FIGS 1 and 2, respectively A suitable control panel 456 can be provided and located in a suitable location, such as on the side of cabinet 402 In the illustrated embodiment, control panel 456 contains a separate display for each of fry wheels 404, 410, 412 and 414 referred to by reference numerals 456*a–d*, respectively Control panels and displays 456*a–d* can include information such as set cycle time, oil temperature, oil level as well as controls to adjust cycle time and oil temperature, for example

Referring to FIG 13, there is illustrated fry wheel 410 Fry wheel 410 includes two opposed circular spaced apart circular disks 458*a* and 458*b* Disks 458*a* and 458*b* can include a plurality of apertures 460 as desired to reduce wheel weight and to provide circulation of cooking oil and to permit passage of water vapor therethrough, such as during frying food products, for example. A fry wheel axle 462 is provided to which disks 458*a* and 458*b* are mounted Axle 462 is suitably mounted, typically and preferably for rotation with respect to fry vat 406 at a location above the normal level of cooking oil or range of levels of cooking oil that will be encountered in fry vat 406 during operation

In one embodiment, outer peripheral edge 464 of each of disks 458*a* and 458*b* include a plurality of teeth 466.

Teeth 466 can be utilized to drive fry wheel 410 in a manner as hereinafter described Referring to FIGS 14–16, there is illustrated in sectional view of disk 458*a* of fry wheel 410, a portion of which is located within fry vat 406 A drive wheel 468 is associated in operative position relative to teeth 466 located on outer peripheral edge 464 of disk 458*a* Drive wheel 468 can be formed from a disk of material of a suitable thickness having a circumferential groove 470 therein Circumferential groove 470 is typically at least or slightly greater than the thickness of disk 458*a* in the area where drive wheel 468 and disk 458*a* are juxtaposed as illustrated in FIGS 14 and 15 A series of spaced apart pins 472 extend across circumferential groove 470 and are radially arrayed and spaced from the center of drive wheel 468 Drive wheel 468 includes a central aperture 474 through which a drive axle 476 can be mounted In operation, drive wheel 468 is rotated by drive axle 476 with drive wheel 468 being positioned a fixed distance from disk 458*a* so that pins 472 mesh with teeth 466 when rotated as illustrated in FIG 14 thereby causing rotation of disk 458*a* and consequently fry wheel 410 in a direction of rotation opposite to the rotation of drive wheel 468, as indicated by arrows K and L of FIG 14

It is to be understood that any suitable drive wheel and drive arrangement can be utilized For example, in place of drive wheel 468 with pins 472, a drive arrangement could be utilized in which a drive gear is utilized to mesh with a corresponding gear located around the periphery of disk 458*a* and/or 458*b*, for example. Alternatively, a friction drive system could be utilized in which a friction drive wheel would contact the edge of one or both of circular disks 458 which could be of a design having no teeth therealong, such as illustrated in alternative embodiment wheels 479 and 481 described hereafter Since the wheel will have cooking oil thereon, the coefficient of friction between the drive wheel and fry wheel will be decreased Care should be taken to assure that when using a friction drive, sufficient pressure is maintained between the driving wheel and the fry wheel

Referring to FIG 16, there is illustrated a drive mechanism for driving drive wheel 468 The drive mechanism includes an electric motor 478, a gear reduction drive 480, an output shaft 482, a drive pulley wheel 484, a driven pulley wheel 486 and a drive belt 488 extending around drive pulley wheel 484 and driven pulley wheel 486 to drive axle 476 which thereby drives drive wheel 468 since the end 476*a* of axle 476 is fixed in aperture 474 with respect to drive wheel 468 A shear pin 490 can be located in a shear

pin aperture **492** of drive wheel **468** to retain axle **476** in a fixed position relative to drive wheel **468** Axle **476** is suitably contained within an axle journal **494** which, in turn, is mounted to frame **496** to permit movement of axle **476** relative to axle journal **494** and frame **496** Similarly, motor **478** and gear reduction drive **480** are suitably mounted to frame **496** If desired, motor **478** may be a stepper motor

Typically, it is important that the fry wheel is rotated in periodic increments for a compartment to be aligned with a respective discharge slide **498** of fry device **400** or other slide, ramp or discharge location after a periodic rotation Typically, the leading edge **500** of a compartment bottom, such as compartment bottom **432'** of compartment **432** as shown in FIG **13** is aligned with the upper edge of fry vat **406** or the top edge of discharge chute **498** associated therewith to allow the contents of compartment **432** to be discharged therefrom As illustrated in FIG **13**, the contents of compartment **432** have already been discharged from fry wheel **410** This is particularly important where incremental rotation of fry wheel **410** is utilized as opposed to a continuously moving fry wheel Thus, for incremental rotation it is desirable for bottom edge **500** of compartment **432** to be aligned with discharge **498** or the upper edge **406'** of fry vat **406** In order to accomplish this, a stepper motor can be utilized to drive fry wheel **410** Alternatively, or in addition, the position of the baskets can be sensed and their position adjusted accordingly to assure that all baskets are in the correct position for loading and discharge during operation Also, utilizing location sensors allows use of a simple DC or AC motor, as opposed to a stepper or servo motor Any suitable sensor can be utilized in conjunction with a control system to control operation of the fry wheel drive motor Suitable sensors include proximity, magnetic reed, Hall Effect, photoelectric and capacitive sensors Such sensors are well known in the art and consequently a detailed description of those sensors is not included herein

In accordance with another aspect of the invention, it should be understood that the height of cooking oil in one of fry vats **406**, **416**, **418** and **420**, such as the level of cooking oil indicated by reference letter H in FIG **13** in fry vat **406** will increase or decrease depending upon the amount of food that is submerged underneath the surface of cooking oil contained in fry vat **406** Thus, as illustrated in FIG **13**, compartments **424**, **426**, **428** and **430** each have a charge of food, in this case French fries **455** contained therein Each compartment contains approximately one pound of French fries **455** Consequently, there are about four pounds of French fries that are beneath the surface level H of cooking oil contained in fry vat **406** This quantity of submerged food raises the level H of cooking oil in fry vat **406** This increase in the level of cooking oil can cause the food to be submerged and therefore cooked for a longer of period of time in the cooking oil For example, contrast the level of cooking oil depicted in FIG **13** with the level of cooking oil depicted in FIG **20** in which a charge of French fries **455** is contained only within compartment **426** This results in a substantially reduced level of cooking oil H' as indicated in FIG **20** Thus, the control system for fry device **400** can be adjusted to take into account for different levels of cooking oil which can be sensed by a suitable sensor as is known by those skilled in the art (not shown) Where rotation of fry wheel **410** is done incrementally after a period of time elapses, the period between incremental rotations can be increased or decreased as desired based on the level of cooking oil present in fry vat **406** For example, in the situation illustrated in FIG **13**, the duration between incremental rotation of fry wheel **410** could be decreased compared to the situation depicted in FIG **20** where the level H' of cooking oil is significantly lower than the level H of cooking oil in FIG **13** This assumes that the temperature of cooking oil in each of the situations depicted in FIGS **13** and **20** is substantially the same Similarly, if a constant rotation fry wheel operation is utilized, such as where fry wheel **410** would rotate constantly, the rotational speed could be increased to handle the situation depicted in FIG **13** compared to the speed of the wheel that would be utilized for the situation in FIG. **20**, where the level H' of cooking oil in FIG **20** is significantly less than the level H of cooking oil in FIG **13**

Referring to FIGS **13** and **20**, frying device **400** can also include a fry wheel follower "or fry wheel liner" **502** which is supported by a fry wheel follower support **504** Fry wheel follower **502** is a curved perforated circular segment having a width approximately equal to the width of fry wheel **410** Fry wheel follower **502** is supported by a pair of fry wheel follower supports **504** that are spaced apart and connected by lateral supports **506** Fry wheel follower **502** prevents food pieces that are larger than the perforations in fry wheel follower **502** from falling from fry wheel compartments **422–436** during operation Preferably, the perforations in fry wheel follower **502** are composed of circular holes having a diameter of about 0 187 inches that are in staggered rows having a center-to-center hole distance of about 0 312 inches Fry vat **406** includes a suitable heating element **505**, illustrated in FIGS **13**, **20** and **21**

Referring to FIGS **17–19** there is illustrated a curved compartment forming member **438** which is composed of two opposed sidewalls **508***a* and **508***b* that are interconnected by a curved J-shaped member **510** that forms compartment bottom **510***a* and compartment top **510***b* Preferably, a wiper **512** is suitably mounted to compartment member **510**

A plurality of compartment forming members **438** are mounted together in fry wheel **410** to provide a plurality of adjacent peripheral food compartments **422–436** as illustrated in FIG **13** As illustrated in FIG **13**, the top of one J-shaped member **510** abuts the bottom of adjacent J-shaped member **510** Thus, advantageously, a fastening member **514**, which can be a rivet, for example, that secures wiper **512** to compartment bottom **510***a* of one curved J-shaped member **510** will also pass through the compartment top **510***b* of the adjacent curved J-shaped member **510** Preferably, wiper **512** has a plurality of transversely extending grooves **516***a–f* that permit drainage of cooking oil therethrough as wiper **512** exits the cooking oil in fry vat **406**, for example

Referring to FIG **17**, opposed sidewalls **508***a,b* and curved J-shaped member **510** are perforated to permit the flow of cooking oil therethrough thereby promoting good heat transfer between the cooking oil contained in fry vat **406** and food contained in one of compartments **422–436** when immersed in cooking oil A suitable hole size is about 0 156 inches spaced center-to-center about 0 250 inches Wiper **512** also ensures that close contact is maintained between the interface of fry wheel follower **502** and the top and bottom ends of each food compartment **422–436** which in each case will be bounded by one of wipers **512** Any suitable material can be used for wiper **512** such as rubber or Teflon, for example

As an alternative construction, compartments **422–436** could be constructed from curved J-shaped members **510** without opposed sidewalls **508***a* and **508***b*, in which case the compartment sidewalls could be formed from opposed circular disks **458***a* and **458***b* In addition, it should be appre-

ciated by one skilled in the art that any desired compartment shape can be utilized in accordance with the invention as long as the food can be loaded into the compartment, kept within the compartment during immersion in the cooking oil and which compartment shape discharges the food from the fry wheel

Referring to FIGS 21 and 22, there are illustrated further aspects of fry device 400 FIG 21 is a sectional view along line 21—21 of FIG 20 FIG 21 illustrates the elements previously described and in addition shows the interface of adjacent fry vats 406 and 420 and in enlarged form in FIG 22 Disposed between fry vats 406 and 420 is a banking strip 518 that bridges the gap between fry vats 406 and 420 Banking strip 518 can be in a shape as desired and in the illustrated embodiment is a generally inverted V-shaped strip that spans the gap between fry vats 406 and 420 Banking strip 518 prevents any material that is discharged between fry wheels 410 and 412 from falling between fry vats 406 and 420 and causing such material to fall into one of fry vats 406 and 420

Referring to FIGS 23 and 24, there are illustrated alternate embodiments of a fry wheel for use in accordance with the invention It is to be understood that the fry wheel is capable of numerous changes and rearrangements, and the fry wheel, as well as other components and embodiments of the present invention, is not intended to be limited to the specific embodiments described herein

Referring to FIGS 23 and 24, there are illustrated wire form wheels 479 and 481 Each of wheels 479 and 481 has a rim 520 and 522, respectively, constructed of tubing, which can be smooth tubing Such a wheel could be driven by a friction wheel, if desired In each of wheels 479 and 481 a plurality of individual tubular spokes 524 extend from each rim to a corresponding hub assembly 526 An axle 528 connects hubs 526 together in each of wheels 479 and 481 Wheel 479 includes a slotted member 530 that bridges each pair of spokes 524 Each slotted member 530 includes a centrally disposed slot 532 and a pair of tabs 534 on either side of slot 532 A plurality of fry baskets 536, one for each slotted member 530 or pair of spokes 524 is mounted in a snap-lock relationship to each slotted member 530 Fry baskets 536 have perforated sides and a perforated bottom and top and can be of a similar configuration as previously described with respect to fry wheel 410 Each basket 536 can have a spring tab member 538 that interlocks with slotted member 530 to secure fry basket 536 to fry wheel 479 resulting in a finished fry wheel 481 as shown in FIG 24 It is to be understood that the embodiment illustrated in FIGS 23 and 24 is not limited to snap-in baskets and that other baskets can be used with the wheel arrangement depicted in FIG 23 with or without slotted members 530 For example, baskets could be welded or otherwise affixed to rim 520 and spokes 524 Each of fry baskets 536 includes perforations 540 on the sides, top and bottom thereof, such as previously described with respect to compartment forming member 438

Referring to FIG 24, there is illustrated an alternative drive mechanism 535 to rotate fry wheel 481 Drive mechanism 535 includes a motor 537, a shaft 539 and drive rollers 541 and structure for supplying a force in the direction of arrow FW Drive rollers 541 are mounted on shaft 539 which can be rotated by motor 537 to cause rollers 541, each aligned with one of rims 522, to rotate, thereby rotating fry wheel 481 A force FW is supplied in the direction of arrow FW to ensure that rollers 541 impart a sufficient tractive force to cause rotation of fry wheel 481. Force FW can be supplied by any suitable structure, including a spring, a weight or an electromagnet, for example For example, motor 537, shaft 539 and rollers 541 could be mounted on a platform (not shown) that is moveable in the direction of arrow FW and a force could be applied to urge platform in the direction of arrow FW to ensure proper traction of rollers 541 Rollers 541 may be constructed of any suitable material, including rubber, for example Motor 537 can be controlled by fry control 116, for example

Fry wheel 410 can be rotated as desired so that food deposited in one of compartments 422–436 travels through and out of the cooking oil 454 until that compartment reaches a discharge location Thus, in the embodiment illustrated in FIGS 13 and 20, the rotation is in a clockwise direction as indicated by arrow K in FIG 13 and arrow K in FIG 20 The rotation of fry wheel 410 can be either continuous or periodic In a periodic rotation, the rotation will typically be incremental, that is, the wheel is rotated to some degree and then stops Thereafter, after a set period of time, the wheel undergoes another periodic rotation This process continues as each fry basket is rotated through and out of the cooking oil vat and to the discharge location. Preferably, each periodic rotation consists of a rotation of 360° divided by the number of compartments present in the fry wheel or some fraction of that periodic rotation increment so that the position of the wheel can be known without the use of sensors However, the use of a sensor or sensors to be able to monitor wheel position can also be used either as the primary way of controlling wheel position or as a backup Also, use of a sensor to determine wheel position allows use of a standard AC or DC motor Suitable control of wheel 410 can be accomplished by fry control 116, for example

In accordance with the present invention, a basket shaking simulation can be achieved Basket shaking simulation can be performed by a relatively slight back and forth rotation of the fry wheel, such as fry wheel 410 Thus, the drive mechanism is activated to rotate the fry wheel clockwise and counterclockwise through a relatively small degree of angular rotation to simulate shaking of a fry basket during frying The back and forth rotation can occur relatively rapidly and typically the degree of angular rotation will be in the range of from about 2 to about 20 degrees In addition, the periodic rotation in one direction may be of a larger angle of rotation than the rotation in the other direction

Preferably, the degree of rotation during simulated basket shaking will be monitored, particularly where the rotation in one direction is greater than the rotation in the other direction so that the position of each basket relative to the discharge location can be monitored by the control system to ensure proper discharge of food from food compartments

Referring to FIG 64, there is illustrated in partially schematic view fry device 400 along with portions of food dispensing device 200 and food packaging device 600 As illustrated in FIG. 64 a hood system 546 is provided. Hood system 546 includes a hood structure 548, a filter 542 and a drip pan 544

A suitable air blower (not shown) can be provided to cause air flow to move within hood system 538 generally in the direction of arrows A1, A2 and A3 Filter 542 thus filters particulate matter in air flow A1 that passes through filter 542 Drip pan 544 catches any matter that drips from filter 542 that is located above drip pan 544 Preferably, hood system 546 substantially completely encloses the area above fry device 400 to reduce waste discharge into the operating environment of automated food processing system 100

Food Packaging Device

Referring to the Figures generally, and in particular to FIGS 1 and 25–50, there is illustrated various embodiments

of food packaging devices and elements thereof in accordance with the invention

In one embodiment, food packaging device **600** is illustrated or partially illustrated and elements useful in connection with food packaging device **600** are illustrated in FIGS **1** and **25–50** Food packaging device **600** includes a cabinet **602** having a countertop surface **636** Food packaging device **600** can be advantageously constructed in modular form so that it can be operated together with previously described food dispensing device **200** and fry device **400** and alternatively operated separately from both or either of those devices

Food packaging device **600** in the illustrated embodiment includes a food inlet chute **604**, rotatable food dispensing member **606**, food dispensing chute mechanism **608**, automated container handling system **610**, container-receiving receptacle **612**, overflow food collection member **613**, conveyor system **614**, waste chute **615**, food seasoning system **616** and raceway **620**

In the illustrated embodiment, food packaging device **600** includes a container storage device for containing cartons or containers of various sizes During operation of packaging device **600**, the device selects a container of a desired size from container storage magazine **638**, erects the container into an erected form that is unerected while contained in storage magazine **638** and then positions the erected container to receive food dispensed from food dispensing chute mechanism **608** After receiving food from food dispensing chute mechanism **608**, automated container handling device **610** is capable of moving the filled or partially filled container to container receiving receptacle **612** which is transported via conveyor system **614** to a desired location for subsequent pickup of the container by a human operator, for example

In the embodiment illustrated in FIGS **25–29**, food packaging device **600** includes food overflow collection member **613** to collect food dispensed by food dispensing chute mechanism **608** that is not deposited into a container In the illustrated embodiment, overflow food collection device **613** is a rotatable wheel as hereinafter described in detail Overflow food collection member **613** functions to collect food dispensed by food dispensing chute mechanism **608** that is not received in a container and to recycle that food into food dispensing chute mechanism **608** for subsequent dispensing to a container This permits food dispensed by food dispensing chute mechanism **608** but not deposited in a container to be promptly recycled to the dispensing chute in a first-in, first-out manner, so that overflow food is promptly recycled and dispensed to a container

Referring to FIGS **26–28**, there is illustrated food packaging device **600** in which inlet chute **604** is positioned to receive food, in this case French fries, from food dispensing lanes **234**, **236** and **238** of dispensing device **200**, which food has been subsequently fried after dispensing in fry wheels **410**, **412** and **414** of fry device **400** After frying in any of wheels **410**, **412** and **414** of fry device **400**, food dispensed therefrom enters inlet chute **604**, as illustrated in FIGS **3** and **28**, for example In inlet chute **604** the food travels downwardly along chute **604** and into rotatable food dispensing member **606** in the direction of arrow M of FIG **28** and arrow E of FIG **3** Inlet chute **604** can be configured as desired and may be configured to accept the product from any one or all of fry wheels **404**, **410**, **412** and **414** In FIGS. **25–27**, a holding area **607** receives product from fry wheel **404** for manual packaging A manual or automated diverter bar **605** can optionally be provided as shown in FIG **27** to divert French fries from device **600** to permit filling unsalted fry orders Bar **605** can be moved between open and closed positions as indicated by arrow Z, such as by a cylinder (not shown)

Rotatable food dispensing member **606** in the illustrated embodiment is a dispensing wheel that is mounted for rotation in dispensing device **600** Dispensing member **606** has a plurality of food containing compartments **640** that are arrayed around the periphery of rotatable food dispensing member **606** Each of compartments **640** is divided from another compartment by a compartment wall **642** Preferably, each compartment wall **642** is not normal to peripheral edge **644** of rotatable food dispensing member **606** but at a slight angle such as, for example, as illustrated in FIG **29** and FIG. **61**

Wheel **606** includes a pair of opposed rim portions **646***a* and **646***b* and a circular ring portion **648** that interconnects opposed rims **646***a* and **646***b* Circular ring **648** is disposed close to the peripheral edges of rims **646***a* and **646***b* and defines peripheral edge **644** Preferably, circular ring **648** is constructed of a perforated metal material so that circular rims **646***a* and **646***b* have perforations **650** therethrough as illustrated in FIG **28**, for example

In accordance with the illustrated embodiment, rotatable dispensing member **606** is configured as a rotatable wheel although other embodiments are within the scope of the invention For example, a rotatable dispensing member in accordance with the invention could be a portion of a wheel, such as a semicircular or other configuration

In the illustrated embodiment, rotatable food dispensing member **606** is rotated by a drive mechanism **652** Drive mechanism **652** consists of a motor **654** that drives a drive wheel **656** Drive mechanism **652** is controlled by a suitable control mechanism to cause rotation of drive wheel **656** and hence rotatable food dispensing member **606** in a desired direction and at a desired rate of speed Drive wheel **656** can be a pressure roller or alternatively can be a drive wheel like or similar to drive wheel **468** previously described with respect to FIG **14** Rotatable food dispensing member **606** can be driven via one or both of opposed rims **646***a* and **646***b* Alternatively, and as illustrated in FIG **28**, rotatable food dispensing member **606** is driven through a drive rim **658** Each of rotatable food dispensing members **606** and overflow food collection member **613** rest on spaced apart rollers **660** and **662** Each of rollers **660** and **662** are constructed to bear the weight of rotatable food dispensing member **606** and overflow food collection member **613** and have a length that spans both Alternatively, separate rollers or some other supporting structure could be used to support rotatable food dispensing member **606** and overflow food collection member **613** An inner curved fender or baffle member **664** as illustrated in FIG **29** is provided to ensure that food contained in compartment **640** of rotatable food dispensing member **606** does not prematurely discharge Preferably, fender **664** follows the inner curvature of rotatable food dispensing member **606** and has perforations **666**, which can be similar to perforations **650** of circular ring **648** Fender **664** is suitably mounted so that it is stationary relative to rotatable food dispensing member **606** A similar fender could also be provided for overflow food collection member **613**, if desired (not shown)

Referring to FIG **61**, there is illustrated an elevation view of a portion of rotatable food dispensing member **606** which is typically rotated in the direction of arrow Y when viewed from the front of food packaging device **600** Fender **664** prevents food, in this case French fries FF, from falling from compartments **640** prematurely

Overflow food collection member **613** is configured to collect food deposited from food dispensing chute mecha-

nism **608** that is intended to be received into container **611** when held in position to receive food from food dispensing chute mechanism **608** which food does not stay in container **611**. This can occur since oftentimes it is desirable to overfill container **611** so that food is mounded up above the top surface of container **611**. Also, for food such as French fries, such food material fills container **611** somewhat randomly and it is typical for French fries to dangle over the sides of container **611**. In the illustrated embodiment, overflow food collection member **613** is configured in a manner similar to rotatable food dispensing member **606** previously described. Thus, food collection member **613** includes opposed rims **668***a* and **668***b* and circular ring **670** having perforations **672**. Circular ring **670** connects opposed rims **668***a* and **668***b* in a manner as previously described with respect to member **606**. In addition, food collection member **613** has a plurality of inner compartments that are similar in construction to compartment **640** previously described with respect to member **606**. Member **613** also has a drive rim **674** and is driven by a drive mechanism **676** that is similar to drive mechanism **652** previously described including a drive wheel **676'** and a motor **678**. Drive mechanism **676** is configured to rotate food collection member **613** in either a clockwise or counterclockwise direction as hereinafter described in more detail.

Food collection member **613** also includes a plurality of compartment walls **680** that are similar to compartment walls **642** previously described with respect to rotatable food dispensing member **606**, providing a plurality of food containing compartments **682**.

Each of food dispensing member **606** and food collection member **613** has bottom portions that are disposed through an opening **684** in countertop surface **636** of cabinet **602**. The construction of the illustrated embodiment permits food dispensing member **606** and overflow food collection member **613** to be readily removed from food packaging device **600** such as for cleaning and/or repair.

A heating system as described can be incorporated into food packaging device **600** to supply heat to food contained therein. For example, a heating system **681** can be provided, which is illustrated in FIG. **29**. Heating system **681** includes a heating device **683** having a heating element **685**, located above dispenser **606** as desired. Heating devices **687** and **689** may also be included within dispenser **606** and/or **613** as desired. The heating devices may comprise radiant heaters and can be ceramic heaters, for example. Any suitable type of heating device or system can be used in accordance with the invention. Heating system **681** can be controlled by packaging control **118**, for example. In addition, a heating device can be provided to direct heat to food container pick up location **622**, if desired to keep food contained thereat warm.

Referring to FIGS. **1, 3, 25–26, 28–29** and **43–44**, various aspects of the configuration and operation of food dispensing chute mechanism **608** are illustrated and will be described. Food dispensing chute mechanism **608** includes an upper chute **686**, a lower chute **688**, a chute support member **690**, a connecting link **692**, a stop member **694**, a rotatable link **696** connecting stop member **694** to chute support member **690**, a rotatable link **698** connecting upper chute **686** to support member **690**, a cylinder **700** for operating food dispensing chute mechanism **608**, a load cell **702** for weighing the contents of food contained in food dispensing chute mechanism **608** and a rotatable link **704** connecting cylinder rod **706** to upper chute **686**.

Upper chute **686** preferably and as illustrated in the referenced figures, forms part of food dispensing chute mechanism **608**, and has an inlet location **708** for receiving food dispensed from rotatable food dispensing member **606** and a discharge location **710** for dispensing food contained in food dispensing chute mechanism **608** and into a container, such as container **611** as illustrated in FIG. **43**, for example.

Upper chute **686** of food dispensing chute mechanism **608** is positioned to receive pieces of food from a discharge location **712** of rotatable food dispensing member **606**. Upper chute **686** has a food holding area **714** for holding food received from rotatable food dispensing member **606**. A weighing device is associated with food dispensing chute mechanism **608** so that the amount of food contained therein, such as in food holding area **714**, can be determined. Any suitable device can be utilized to determine the amount of food contained in food dispensing chute mechanism **608**. In the illustrated embodiment, a load cell **702** is provided to determine the weight of food contained in food dispensing chute mechanism **608** and is illustrated schematically in FIGS. **43** and **44**, for example.

FIG. **44** illustrates food dispensing chute mechanism **608** in the upper position ready to receive food from rotatable food dispensing member **606**. In that configuration, cylinder **700** is retracted and upper chute **686** is generally horizontal. This configuration allows a quantity of food to be dispensed into upper chute **686** and into food holding area **714** without being dispensed therefrom. When a sufficient quantity of food is deposited in upper chute **686**, such as French fries FF, as determined by load cell **702** which communicates with the control system of food packaging device **600**, the food contained therein is ready to be dispensed. Typically, the amount of food contained in chute **686** will be sufficient to adequately fill container **611**. Since container **611** is of a known size, rotatable food dispensing member **606** can be operated to supply food to chute **686** until a desired quantity is contained therein for dispensing to container **611**.

To dispense food from food dispensing chute mechanism **608**, cylinder **700** is activated to extend cylinder rod **706** upwardly thereby causing upper chute **686** to drop. Since lower chute **688** is connected to upper chute **686** via connecting link **692**, lower chute **688** also drops to the discharge position as illustrated in FIG. **43** which movement is indicated by arrow S. Stop **694** which is connected to lower chute **688** and pivotally mounted via rotatable link **696** to chute support member **690**, engages chute support member **690** as illustrated in FIG. **43** and prevents further downward movement of upper chute **686** and lower chute **688**. In addition, stop member **694** engaging chute support member **690** defines the lowermost position of upper chute **686** and lower chute **688** which is also the dispensing position of food dispensing chute mechanism **608**, as illustrated in FIG. **43**. This position also provides discharge location **710** of dispensing chute mechanism **608**.

Referring to FIGS. **25–28**, there is illustrated container storage magazine **638**, which can form part of food packaging device **600**. Container storage magazine **638** is configured to store a plurality of different sized food containers in an unerected form. Typically, container storage magazine **638** will be configured to hold a variety of different sized containers. In the illustrated embodiment, container storage magazine **638** can contain four different sizes of French fry containers or cartons. Container storage magazine **638** includes a base **716** that is suitably mounted with mounting structure **718** to cabinet **602**. Preferably, mounting structure **718** permits container storage magazine **638** to be readily removed to permit access to rotatable food dispensing member **606** and overflow food collection member **613**.

Base 716 typically can be in the form of a base plate and includes four apertures 720, 722, 724 and 726, each of said apertures corresponding to the profile of a different size collapsed carton. Apertures 720, 722, 724 and 726 are dimensioned to be able to retain a stack of cartons in a collapsed or unerected condition as illustrated in FIG. 25 in which a plurality of unerected cartons 728 are stacked therein.

Each aperture 720, 722, 724 and 726 and base 716 has associated therewith a plurality of guide members 730-760. In the illustrated embodiment, guides 730–760 are in the form of post or tubular-type members. Each set of four guide members is associated with a specific one of apertures 720, 722, 724 and 726 to define and permit stacking of a plurality of unerected French fry cartons or containers that generally correspond in size to the size of apertures 720, 722, 724 and 726, respectively. It is to be understood that other arrangements to define a container stack can be utilized in accordance with the invention. For example, in place of guides 730–760 other structure could be utilized, such as upstanding walls or partial walls or other types of guides.

Container storage magazine 638 may also include a suitable removable cover (not shown) to enclose base 716 and the volume defined over apertures 720–726 by guides 730–760.

Container storage magazine 638 is preferably positioned to permit ready access to the bottom of each container stack through the bottom of each of apertures 720–726 by automated container handling system 610, which is hereinafter described in detail.

Food packaging device 600 includes automated container handling system 610. Automated container handling system 610 is capable of retrieving an unerected container through any of apertures 720, 722, 724 and 726 of unerected container storage magazine 638, erecting the unerected carton, holding the erected carton in position at discharge location 710 of food dispensing chute mechanism 608 and depositing the filled container onto conveyor system 614, which conveyor system 614 subsequently transports the filled container to a desired location.

Referring to FIGS. 1, 25, 27–28 and 30–44, there is illustrated automated container handling system 610 and elements and features thereof. Automated container handling system 610 includes a container retrieving and grasping device 762, a container grasping device 764 and a container bottom urging device 766.

Automated container handling system 610 is controlled by a suitable control system for food packaging device 600.

Container retrieving and grasping device 762 and portions thereof are best illustrated in FIGS. 30–39. Container retrieving and grasping device 762 includes a mast 768, which is mounted to a carriage system 770, a moveable rack member 772, a pinion 774, a frame 776, a container grasping member 778 and a linkage assembly 780.

Mast 768 is carried by carriage system 770 which carriage system 770 allows for lateral translation of mast 768 and the components associated therewith, including moveable rack member 772, pinion 774, frame 776, container grasping member 778 and linkage assembly 780. Carriage system 770 includes a guide member 782, a worm gear 784, a drive mechanism 786 and a carriage follower 788. Carriage follower 788 supports a vertical translation mechanism 790 that, in turn, carries mast 768.

Carriage guide 782 is an elongated guide that defines the lateral translation movement direction of carriage follower 788 and is secured within cabinet 602. Worm gear 784 is disposed parallel to carriage guide 782 and when rotated moves carriage follower 788 along carriage guide 782.

Worm gear 784 is driven by drive mechanism 786 which can include a drive motor 792, a drive gear or pulley 794 and a driven gear or pulley 796. Where drive and driven pulleys are used, typically a belt 798 will impart rotation from one pulley to another.

Drive motor 792 causes worm gear 784 which is mounted for rotation and which is rotated by rotation of driven pulley or gear 796 in either direction. Drive motor 792 can be an AC or DC motor or a stepper or servo motor as desired. Suitable sensors can be employed (not shown) to determine the position of carriage follower 788 which determines the lateral position of container grasping member 778.

Carriage follower 788 is composed of a frame 800 having a guide aperture or slot 802 in which carriage guide 782 is disposed and a threaded aperture or slot 804 in which elongated worm gear 784 is disposed to impart lateral motion to carriage follower 788 by rotation of worm gear 784. Thus, carriage system 770 provides lateral movement in the direction of arrows Q as shown in FIG. 39. In this manner, carriage follower and thus mast 768 can be laterally translated as desired.

A suitable opening 806 is located in countertop surface 636 of cabinet 602 to permit mast 768 to extend therethrough.

Mast 768 can be raised and lowered in a vertical direction as indicated by arrow V in FIG. 39.

Mast 768 can be vertically raised and lowered in the directions indicated by arrow V in FIG. 39 by operation of a drive mechanism 810 that forms part of vertical translation mechanism 790. Vertical translation mechanism 790 is a vertically extending carriage system similar to that described with respect to carriage system 770 and includes a drive mechanism 810 which is composed of a motor 812 which is carried by carriage follower 788, a vertically disposed carriage guide 814, a vertically disposed worm gear 816 which is driven in a suitable manner by motor 812 such as previously described with respect to drive mechanism 786 of carriage system 770, which can be controlled in a similar manner. Vertical translation mechanism 790 also includes a vertical carriage follower 818 having a threaded aperture or slot and a guide aperture or slot (not shown) which vertical carriage follower 818 is secured to mast 768.

Mast 768 has mounted thereto frame 776, typically at an upper end thereof. Linkage assembly 780 is secured to frame 776 as well as pinion 774 and moveable rack member 772.

Moveable rack member 772 includes a frame 820 having a guide slot 822 vertically disposed therein and a rack 824 which meshes with pinion 774. Moveable rack member 772 may also include extra mass in the form of a weight block 826 to help urge moveable rack member downwardly when not restrained.

A pair of guides 828 and 830 are rigidly secured to frame 776 and are disposed within slot 822 of moveable rack 772. A spring 832 can be connected between an upper end of moveable rack member 772 and guide 828 or 830 to urge moveable rack member 772 to a lower position as illustrated in FIG. 30 compared with the upper position as illustrated in FIGS. 34–37.

In a preferred embodiment, moveable rack member 772 includes a stop 834 which stop can be vertically adjustable. While stop 834 is located at the bottom of moveable rack member 772 it is to be understood that a stop could be provided at another location provided that a suitable engaging surface at a proper location is provided.

Mounted to frame 776 is an axle 836 that is mounted for rotation relative to frame 776. Axle 836 has pinion gear 774 rigidly secured thereto as well as one end 838 of linkage 780.

The other end 840' of linkage 780 is securely mounted to frame 776 as illustrated in FIGS. 30–37, for example.

Linkage 780 which carries container grasping member 778 is composed of a plurality of links so that container grasping member 778 is moveable from a horizontal position as illustrated in FIGS. 30–32 to a vertical position as illustrated in FIGS. 34–37. When container grasping member 778 is in the horizontal position it is utilized to grasp and retrieve a desired size of container from one of the apertures 720, 722, 724 and 726 from container storage magazine 638. For this purpose, container grasping member 778 includes a suction cup device 842 which includes at least one suction cup 842 and in the illustrated embodiment two suction cups 842 and 844 arrayed in substantially the same plane for grasping a container having a surface to be grasped by both suction cups 842 and 844 in the same plane. Suction cup device 842 also includes a vacuum source 846, a release valve 848 and a suitable vacuum line 850 which connects suction cups 842 and 844 to vacuum source 846, as illustrated in FIG. 30, for example. In operation, when suction cups 842 and/or 844 engage a container or other member to be grasped, vacuum source 846 is activated to supply vacuum to suction cups 842 and 844, such as to grasp and retain a container from one of apertures 720, 722, 724 and 726 of container storage magazine 638.

Linkage assembly 780 includes, in the illustrated embodiment, a first link 852, a second link 854 and third link 856.

First line 852 is rigidly secured to axle 836 and pinion 774. First link 852 is configured in an L-shape with the end of first link 852 opposite the portion connected to axle 836 pivotally connected to second link 854 having one end being pivotally connected to first link 852 via pivot connection 858.

Second link 854 is connected to third link 856 via a universal joint connection 860 a location spaced apart from pivot connection 858 as illustrated in, for example, FIGS. 30–37. Section cups 842 and 844 are mounted to second link 854. An offset member 862 which depends from second link 854 provides a desired offset for universal joint connection 860 which connects second link 854 to third link 856.

Third link 856 is, in turn, connected to frame 776 via a universal joint connection 864 which is at a distance removed from universal joint connection 860 which connects third link 856 to second link 854. An offset member assembly 866 is rigidly secured to frame 776 and includes an angled block 868 and an offset extension 870 to provide the desired angled and clearance for universal joint 864 and third link 856.

In operation, when moveable rack member 772 is moved relative to mast 768, such as when stop 834 contacts a surface, such as in the illustrated embodiment, countertop surface 636 as illustrated in FIG. 36, continued downward vertical movement of mast 768 causes rack member 772 to move upwardly relative to mast 768. This causes rotation of pinion 774 which meshes with rack 824 mounted to rack member 772. Rotation of pinion 774 in a counterclockwise direction in FIG. 30 causes rotation of first link 852. Such rotation causes downward movement of that portion of first link 852 that is pivotally connected to second link 854 via pivot connection 858. Such movement, in turn, causes second link 854 to pivot upwardly about pivot connection 858 in a clockwise direction as viewed in FIG. 30 to cause suction cups 842 and 844 to move to a vertically oriented position as depicted in FIGS. 34–37 from the horizontally oriented position depicted in FIGS. 30–33. In addition, such movement of first link 852 causes movement in rotation of third link 856 and universal joint connection 860 and 864 to the position indicated in FIGS. 34–37. When container grasping member 778 is in the position indicated in FIGS. 34–37, an unerected container held by suction cups 842 and/or 844 will be vertically oriented when suction cups 842 and/or 844 are attached to the container sidewall, as illustrated in FIG. 40, for example.

In a typical operation, container retrieving and grasping device 762 will be operated to position suction cups 842 and 844 below a container to be selected from container storage magazine 638. Mast 768 will be raised by operation of vertical translation mechanism 790 to a desired height so that suction cups 842 and 844 engage a container contained at the bottom of container storage magazine 638. Vacuum source 846 is activated and mast 768 can be lowered to remove a container from a desired one of apertures 720, 722, 724 and 726 of container storage magazine 638. Carriage system 770 can be activated to move container retrieving and grasping device 762 laterally to a desired location. Such lateral movement can be controlled by properly positioned sensors 872, 874, 876, 878 and 880, for example. For example, sensor 872 can define the position to retrieve a container from aperture 720, sensor 876 to retrieve a container from aperture 722, sensor 878 to retrieve a container from aperture 724 and sensor 880 to retrieve from aperture 726. Sensor 874 can be positioned to define the proper location of container grasping member 778 to erect the container that has been retrieved from one of apertures 720, 722, 724 or 726 of container storage magazine 638, as hereafter described. After erecting the container, the vacuum applied to suction cups 842 and 844 is released by operation of release valve 848 which permits suction cups 842 and 844 to disengage and release the container that had been grasped. Mast 768 can then be raised causing stop 834 to be removed from countertop surface 636 and by action of weight 826 and operationally spring 832, causing rack member 772 to move downwardly relative to mast 768 thereby rotating pinion gear 774 clockwise relative to the position shown in FIG. 34, thereby moving linkage assembly 780 to cause movement of container grasping member 778 from the position illustrated in FIGS. 34–37 to the position indicated in FIGS. 30–33, where container grasping member 778 is in position to retrieve a desired carton from container storage magazine 638 in a manner previously described, which includes lateral translation of container grasping member 778 by carriage system 770.

It is to be understood that any suitable automated device or system for retrieving, grasping and moving a container to a desired location as desired herein can be utilized in accordance with various aspects of the present invention. Thus, various aspects of the present invention are not limited by the particular embodiment of container retrieving and grasping device 762 and components thereof described herein. For example, an automated or robotic arm could be utilized to select, grasp and retrieve erected or unerected containers from a source as desired and then erect the carton or container in a suitable manner, followed by holding the erected container at dispensing location 710 and after filling placing the filled container, such as container 611 on to a suitable conveyor to move the filled container to a desired location.

Container grasping device 764 of container retrieving and grasping device 762 will now be described, and in particular with reference to FIGS. 38 and 40–44.

Container grasping device 764 includes a rotatable and vertically translatable mast 884. Mast 884 can be rotated as illustrated by arrow P in FIG. 38 and vertically translated up

and down as indicated by arrow O also in FIG 38 Mast 884 is connected to a shaft 886 via a slot and key arrangement between mast 884 and shaft 886 permitting mast 884 to be rotated by shaft 886 which, in turn, can be rotated by a step or motor 890 or other suitable motor or device to rotate shaft 886 a desired degree. Motor 890 drives a drive pulley or gear 892 which, in turn, drives a driven pulley or gear 894 In the case where pulleys are utilized, a belt 896 is used to transmit rotation from pulley 892 to pulley or gear 894 Motor 890 can be a stepper router or a servo motor as desired. Alternatively, an AC or DC motor can be utilized provided that a suitable control is provided so that the orientation of mast 884 can be determined. A carriage system 898 is utilized to provide the desired vertical movement of mast 884 in up and down directions Carriage system 898 is similar to carriage system 770 previously described and includes a carriage guide 900, a worm gear 902, a carriage follower 904, a drive mechanism 906 which includes a motor 908 (which can be a servo motor or an AC or DC motor) suitably controlled to drive or gear 902. Carriage follower 904 includes a threaded aperture or slot 910 which communicates with worm gear 902 and a threaded aperture or slot 912 in which guide 900 is disposed A carriage follower interface 914 connects carriage follower 904 to mast 884 and permits shaft 886 to rotate with respect to carriage follower interface 914 Thus, in operation, rotation of motor 908 rotates worm gear 902 thereby translating carriage follower 904 up or down depending on the direction of rotation A suitable sensor (not shown) can be employed to determine the height of mast 884 for control by control system 118 for packaging device 600

Suitable mounting structure 916 is provided to mount container grasping device 764 to a desired location, such as within cabinet 602 A slot and key arrangement between shaft 886 and mast 884 permits 884 mast to be vertically translated either up or down while shaft 886 is rotated

Mounted on the upper end of mast 884 is a suction device 918 which includes a suction cup 920, a source of vacuum (not shown) for suction cup 920 and a release valve (not shown) for releasing the vacuum to suction cup 920 Vacuum can be supplied from within mast 884 to suction cup 920 by a suitable connection as is known in the art

Container bottom urging device 766 consists of a mast 922 that is vertically translatable up and down by suitable apparatus (not shown) Such apparatus can be similar to vertical translation mechanism 790 previously described with respect to container retrieving and grasping device 762 Preferably, mast 922 has a blunt end 924

In operation, container retrieving and grasping device 762 selects an appropriately sized container from container storage magazine 638 as directed by the control system for food packaging device 600 After retrieving the container, which in this case is container 611, container retrieving and grasping device 762 moves container 611 to a position as indicated in FIG 40 against suction cup 920 so that opposed sidewalls of container 611 are grasped by suction cups 840 and 842 of container grasping member 778

Next, as shown in FIG 41, container grasping member 778 is moved laterally away from suction cup 920 while maintaining suction on suction cups 842 and 844 Container 611 is partially erected as shown in FIG 41 with bottom 611*b* depending downwardly slightly Container bottom urging device 766 is then activated as illustrated in FIG 42 to urge bottom 611*b* of container 611 upwardly into the fully erected position Container grasping member 778 is released and retracted from container 611 and returned to a horizontal up position to select another unerected container for erection

Next, mast 884 is rotated approximately 90° by motor 890 to place container 611 in discharge position 710 of food dispensing chute mechanism 608 Food dispensing chute mechanism 608 is then lowered to discharge French fries FF therefrom and into container 611 Any French fries that are not received into container 611 are collected by overflow food collection member 613 which is then rotated clockwise in the direction of arrow X as shown in FIG 41 to recycle such French fries to upper chute 686 for subsequent delivery to another container After the French fries are dispensed from food dispensing chute mechanism 608, cylinder 700 is retracted placing food dispensing chute mechanism 608 in the upper position as shown in FIG 44 Mast 884 can then be rotated back and forth slightly (e g , such as 2° to 20°, for example) to simulate shaking to dislodge any loose French fries or dangling French fries in container 611 and any dislodged French fries will then fall into overflow food collection member 613 for subsequent recycling Mast 884 can also be raised and lowered slightly and relatively quickly either before, during or after the angular rotation to further simulate shaking Thereafter, mast 884 is rotated approximately 180° until container 611 is directly over container-receiving receptacle 612 as indicated by T in FIG 44 Mast 884 is then lowered by operation of carriage system 898 until the bottom of container 611 rests in container-receiving receptacle 612 Then, the vacuum supplied to suction cup 920 is released and suction cup 920 releases from container 611 Mast 884 can then be rotated 90° so that it is in position to receive another container to be erected

Container-receiving receptacle 612 is then transported via conveyor system 614 which will now be described in detail

Conveyor system 614 and portions or elements thereof are illustrated in various figures including FIGS 1, 25–29 and 45–50

Conveyor 614 includes, in the illustrated embodiment, raceway 620 which can be formed along the surface of countertop 636 or on some other surface as desired Raceway 620 is preferably in the form of a continuous loop raceway and is defined by spaced apart guides 620*a* and 620*b* mounted to countertop 636 to guide receptacles 612 Conveyor system 614 includes one or more and typically a plurality of container-receiving receptacles 612 which are illustrated in detail in FIGS 46–50 Gate structure 634 of conveyor system 614 includes a first gate 926 and second gate 928 First gate 926 is moveable and typically second gate 928 can be stationary as hereinafter described

Conveyor system 614 also includes structure for causing movement of container-receiving receptacle 612 In the illustrated embodiment, container-receiving receptacles 612 are moved via an endless loop 930 that can be located beneath countertop 636 Endless loop 930 carries a plurality of magnets 932 as illustrated in FIGS 45 and 49, for example Magnets 932 are spaced along endless loop 930 Endless loop 930 may comprise a chain or other suitable structure that can be driven by a drive system that includes sprockets 934, 936, 938 and 940 One of sprockets 934, 936, 938 and 940 can be a driven sprocket

Any suitable endless loop 930 can be utilized such as a belt or a chain Pulleys could be used in place of sprockets 934–940 The route of endless loop 930 follows the route of raceway 620

Container-receiving receptacle 612 typically includes a base 942 and a container-receiving well 944 located over base 942 Base 942 includes an enclosed compartment 946 which can be conveniently accessed by a base plate 948 located along the bottom of base 942 that is fastened to base 942 by suitable fasteners 950 Contained within enclosed compartment 946 is a magnet 952

Container-receiving receptacle **612** follows the movement of magnet **932** due to magnetic attraction between magnets **932** and **952** thereby causing movement of container-receiving receptacle **612** along raceway **620**

Enclosed compartment **946** is dimensioned to permit magnet **952** to be free to rotate therein allowing container-receiving receptacle **612** to be readily guided by rails **954** and **956** that are raised above countertop **636**

Movable gate **926** prevents movement of container-receiving receptacle **612** located thereat as illustrated in FIG **45** This ensures that container-receiving receptacle **612** is in position to receive a loaded container of French fries, such as container **611** from container grasping device **764** After a filled container is placed on container-receiving receptacle **612** adjacent moveable gate **926**, gate **926** is automatically removed by a suitable mechanism (not shown) to permit container-receiving receptacle **612** thereat to be moved by conveyor system **614** until French fry container **611** contained therein contacts gate **928** or receptacle **612** contacts another receptacle that is located at pick up area **622** as shown in FIG **45** Once container **611** is moved from receptacle **612***b*, receptacle **612***b* is then free to move along raceway **620** and passes underneath second gate **928**, which can be a stationary gate Alternatively, second gate **928** could be a moveable gate and could be located at a level that directly prevents movement of receptacle **612***b* After receptacle **612***b* passes underneath second gate **928**, receptacle **612***a* is moved into the position formerly occupied by receptacle **612***b* provided that receptacle **612***a* has a French fry container thereon which would then cause receptacle **612***a* to be stopped at gate **928** Similarly, when that container is removed from receptacle **612***a*, receptacle **612***a* would then be free to pass underneath gate **928** and around that portion of raceway **620** until encountering gate **926** or another receptacle that is stopped by gate **926**

Referring to FIGS **51–60**, there is illustrated various views of French fry cartons that are useful in accordance with the present invention The French fry cartons depicted in FIGS **51–60** are particularly suitable for use in conjunction with the present invention since the cartons readily stand upright without assistance and can be erected by automated container handling system **610**, previously described

FIG **51** illustrates a front elevation view of a carton **1012** that is particularly suitable for containing French fries, for example Carton **1012** is illustrated in FIG. **51** in an erected or opened position and includes a pair of opposed curved sidewalls **1014** and **1016** and a bottom panel **1018**

Carton **1012** can be stacked in a collapsed configuration and stored in a suitable magazine, such as container storage magazine **638** as previously described When in a collapsed position, carton **1012** is particularly suited to being opened or erected by pulling sidewalls **1014** and **1016** apart and urging bottom panel **1018** upwardly, as described with respect to the erection or opening of container **611** by automated container handling system **610** Container or carton **611** is of a design that is similar to carton **1012**

Carton **1012** also includes two supporting legs **1020, 1022** that extend downwardly from the lower portions of the overlapping edge portions of sidewall **1014** indicated by reference numerals **1014***a* and **1014***b* in FIG **59** and FIG **53**

Carton **1012** is capable of standing on its own because of legs **1020** and **1022** that extend below bottom panel **1018** when carton **1012** is open or erected

Carton **1012** can be constructed from a single blank of paperboard which is illustrated in FIG **59** When constructed, sidewall edge portions **1014***a* and **1014***b* form flaps that are glued to the edges of sidewall **1016** as indicated in FIG **54**, for example

Bottom panel **1018** is specially configured to facilitate opening or erection of carton **1012** by an automated carton handling device such as automated container handling system **610**, previously described in detail Bottom panel **1018** includes intersecting lines **1024** and **1026** Intersecting lines **1024** and **1026** intersect at a generally central location of bottom panel **1014**, which panel is generally oval even though it may incorporate straight edges **1028** and **1030**, for example Intersecting lines **1024** and **1026** may be fold lines, lines of weakening, score lines or even perforations All such structures are referred to herein with respect to intersecting lines **1024** and **1026** of bottom panel **1018** only as "fold lines " Typically, the intersection of fold lines **1024** and **1026** form an angle in the range of from about 60° and about 120° In one embodiment, the intersecting bottom panel fold lines are oriented such that one of said lines (fold line **1024** in FIG **59**) is normal or at least generally normal to curved sidewalls **1014** and **1016** In such embodiment, the other of the intersecting fold lines (in this case fold line **1026**) is at least generally parallel to curved sidewalls **1014** and **1016**

Preferably, fold line **1024** extends from sidewall **1014** to sidewall **1016**

As previously mentioned, carton **1012** is foldable to a collapsed position with sidewalls **1014** and **1016** being planar and in contacting overlying relation to each other with bottom panel **1018** being divided into two overlying panels **1018***a* and **1018***b* by intersecting fold line **1026**

Preferably, bottom panel **1018** includes two additional fold lines **1032** and **1034** on either side of fold line **1024** that extends from one carton sidewall to the other, in this case from sidewall **1014** to sidewall **1016**. Secondary fold lines **1032** and **1034** further facilitate the opening or erection of container **1012** with an automated device such as automated container handling system **610**

FIG **58** illustrates a carton **1036** that is similar in construction to carton **1012** previously described except that carton **1036** is of a different size Preferably, carton **1012** is configured such that the width of the base is relatively narrow and the sidewalls **1014** and **1016** flare outwardly so that container **1012** is substantially wider at the top (from about 1.6 to 2 or more times the base width) This allows relatively large and tall containers to be placed in an automobile cup holder CH as depicted in FIG **56**

Referring to FIG **2**, there is illustrated an alternate embodiment of an automated food processing system **101** in accordance with the invention Automated food processing system **101** includes a food dispensing device **201** which is similar to food dispensing **200**, previously briefly described, where like reference numerals represent like elements Food dispensing device **201** includes fewer uncooked bulk food dispensing containers **204** and additional magazine food dispensers that are similar to magazine food dispenser **206**, previously referred to Otherwise, dispensing device **201** is similar to dispensing device **200** previously described

Automated food processing system **101** also includes fry device **400** which has been described

One primary distinction between automated food processing system **100** and automated food processing system **101** is that automated food processing system **101** does not include an automated packaging device such as automated packaging device **600** In place of food packaging device **600**, a food storage device **635** is provided Food storage device **635** allows food cooked by food frying device **400** to be stored in a heated environment for subsequent manual

processing As configured in FIG 2, food storage device 635 includes separate product receiving receptacles 637, 639, 641 and 643 Each receptacle 637, 639, 641 and 643 is dedicated to receiving food from a respective one of fry wheels 410, 412, 414 and 404, respectively In addition, each receptacle 637-643 can have placed therein a suitable container to receive food, such as handled trays 645, 647, 649 and 651

As illustrated in FIG 2, a food item F is being discharged from fry wheel 414 down a chute 653 and into handled tray 649 contained within heated receptacle 641 Food item F can be stored therein for a period of time until it is ready for subsequent processing

Referring to FIGS 62 and 63, there is illustrated heated receptacle 643 in a cross-sectional view and FIG 63 is a cross-sectional view taken along line 63—63 of FIG 62 showing the entire width of receptacle 643

As illustrated in FIGS 62 and 63, heated receptacle 643 is a heated well having a heating element that heats sidewalls 962, 964, 966 and 968 as well as bottom 970 of heated receptacle 643 Heating element 960 is in close proximity to walls 962, 964, 966 and 968 as well as bottom 970 Heating element 960 may be composed of a single heating element or multiple heating elements as desired Suitable controls may be provided to adjust the temperature of walls 962–968 as well as bottom 970 of heated receptacle 643 In addition, suitable insulation 972 can be contained within the cavity that is defined by cabinet 974 of food storage device 635, which is partially shown in FIGS 62 and 63

Preferably, handled trays 645–651, such as handled tray 651 depicted in FIGS 62 and 63 are dimensioned such that they are in close proximity to walls 962–968 and bottom 970 when placed in heated receptacle 643

Food packaging device 600 may optionally include food seasoning device 616, which is illustrated in detail in FIGS 65–68 Food seasoning device 616 includes a hopper 972, a metering wheel 974, a wheel drive system 976, a dispensing tube 978 and a dispersion head 618

Hopper 972 is configured to hold a desired bulk quantity of a seasoning material, such as salt S Bulk hopper 972 includes a lid 982 that can be removed to replenish the supply of salt S contained therein Hopper 972 can have a bottom with inwardly extending sidewalls 984 to facilitate the dispensing of material from bottom 986 of hopper 972 which may include a dispensing tube 988

Metering wheel 974 is located beneath bottom 986 and dispensing tube 988 to receive a charge of salt or other seasoning therefrom Metering wheel 974 includes a cavity 990 for receiving a charge of salt from dispensing tube 988 Metering wheel 974 is rotatably mounted in a housing 992 and can be rotated about the longitudinal axis of metering wheel 974 to cause cavity 990 to be directed downwardly which thereby causes the seasoning or salt contained in cavity 990 to fall by gravity therefrom

Metering wheel 974 is suitably rotated by wheel drive system 976 Wheel drive system 976 can be controlled by a suitable electronic control system that can form part of the food packaging device 600 Typically, in operation, when French fries FF are dispensed from one or more of fry wheels 404, 410, 412 and 414 onto chute 604, a suitable sensing device (not shown) senses the presence of French fries and activates wheel drive system 976 of automated food seasoning device 616 to discharge a predetermined quantity of seasoning, such as salt, onto the French fries that traverse chute 604

Dispensing head 618 can be located in a desired position to apply seasoning to the food traversing chute 604 As illustrated in FIG. 3, for example, dispensing head 618 can be located towards a bottom portion of inlet chute 604 and may extend over a portion of rotatable food dispensing member 606

Wheel drive system 976 as illustrated in FIGS 65–68 includes a solenoid plunger 994 for driving a linkage 996 that is connected to metering wheel 974 to impart rotation to metering wheel 974 Linkage 996 includes a crank arm 998, one end of which is connected to a central portion of metering wheel 974 and the other end is connected to a lever arm 1000 which, in turn, is connected to solenoid plunger 994 Lever arm 1000 can be driven by solenoid plunger 994 which, in turn, causes crank arm 998 to be driven, thereby rotating metering wheel 974 sufficiently to cause cavity 990 to be directed downwardly, thereby permitting any seasoning or salt contained therein to be dispensed therefrom

A collection funnel 1002 is disposed at the discharge end of housing 992 and connects to dispensing tube 978 Dispensing tube 978 is, in turn, connected to dispensing head 618

Dispensing head 618 can include a plurality of vanes 1004 for facilitating dispersion of seasoning dispensed therefrom As illustrated, there are four vanes 1004 spaced 90° from each other

Dispensing tube 978 has a lower end portion 1006 that terminates some distance above dispensing cone 1008 of dispensing head 618 In one embodiment, lower end portion 1006 of dispensing tube 978 may terminate approximately 0 25 inches from the tip of dispersion cone 1008

Dispersion cone 1008 includes a plurality of holes 1010 that are arrayed through dispersion cone 1008 to facilitate the distribution of seasoning or salt In operation, as salt or seasoning is dispensed through lower end portion 1006 of dispensing tube 978, the seasoning strikes the top portion of dispersion cone 1008 and is directed into four quadrants via vanes 1004 As the seasoning traverses the surface of dispersion cone 1008, some of the seasoning falls through holes 1010 in dispersion cone 1008 Note that not all of holes 1010 are labeled, for purposes of clarity in the Figures Other salt or seasoning particles do not fall through holes 1010 but fall off the lower end of dispersion cone 1008 Still other seasoning particles bounce or are otherwise deflected off the top surface of dispersion cone 1008 and fall a lateral distance removed from dispersion cone 1008 In this manner, a good distribution of seasoning is achieved over a relatively large area

The Control System and Method

In one embodiment, the System Master Controller of a Server (PC), a router/hub, and a touch-screen monitor (user interface) The Master can utilize existing technology to integrate, to manage, to control, and to coordinate information flow of and through the various subsystems for overall system operation The network technology is fully compliant with the latest version of the industry's NAFEM Protocol

Control System Features

Referring to FIGS 69–73, the primary functions of the Control System are to receive order information from the POS and to connect and coordinate all operating subsystem controllers with the Master Controller so that operational commands and functional information can be communicated and displayed The result is that all the dispensing, fry and packaging modules function as one integrated fried foods production system

In one embodiment, the Control System is event and demand driven That is, nothing happens unless a functional component or subsystem receives a command signal to

initiate the action In a normal operation mode, the POS will provide virtually all of the system order demands These can take the form of a string of two-bit Order Events Typically this will be a quantity and an item (for example, 2 each regular size fries) The product description can consist of both the food item and its portion size, treated as one bit of information

The Control System information can be categorized into Order Events, Inbound Events, and Outbound Events The Order Events come from primarily the POS system, the historical kitchen management system (KMS) data, or the touch-screen Monitor if a manager wants to override the automatic ordering. KMS is a database of information of, for example, the sales rate of various products versus day and time The Order Events dictate and demand the operation and performance of the automation control system for production The Inbound Events information includes messages generated by subsystem controllers other than the POS or KMS The Outbound Events include typical command messages issued by the Master Controller specifying functions to be performed by individual subsystem controllers

In one embodiment, the Master Controller is configured to monitor periodically or continuously the network for events to occur Once an event takes place and a signal is sent on the network, the Master Controller identifies the source of the signal, then compares it to the programmed schedule of events within its memory, and reacts appropriately, either sending out a new command, showing a display, storing information in memory, or all of the above

An important source of data for the Control System can be the Kitchen Management System (KMS) The KMS is a historical database of operational information This information can be used to set the workstation configuration, process settings, inventory levels, and set a level of production in advance of actual customer demand orders This interface can be a two-way connection, so that all operational data from the Fried Foods Workstation can be received and stored in the KMS and/or the Control System, or evaluated, adjusted, and re-entered to "fine-tune" the process on a continuing basis

Generally, the Control System can comprise two loops, shown in FIG 70 The primary loop is the "Order-to-Package" loop, whereby the Master Control takes an Order Event input from the POS and directs the appropriate Packaging Module subsystem to package and deliver an appropriate portion of product. A secondary loop is the "Buffer Replacement" loop, where the Master Controller receives an Inbound Event signal from the Packaging Module that its buffer inventory of ready-to-package fried product is low and additional product must be dispensed and fried. As currently specified, all products other than salted French fries typically can have a default buffer inventory of zero, meaning that an order for that (other) product will immediately initiate a full dispense-fry-package (if packaged by the System) production routine

In accordance with one aspect of this embodiment of the Control System, the Fryer Module vat operation is not directly controlled by the production demand cycle Each fry vat of the fry module will operate continuously and on a pre-set uniform operating cycle Frozen product is dropped into the fry module when additional inventory is called for The product is fried according to the pre-set cooking cycle and then is dumped into the Packaging (or Protein) Module receiving apron None of the cooking cycle is affected by order demands, or inventory conditions. In one embodiment, the Control System can vary the time between incremental rotation and speed of rotation of fry wheel **410** to accommodate for varying conditions, such as the level of cooking oil in the fry vat. The level of cooking oil can vary as a result of the amount of product that is being fried in a particular fry vat, since product present in the fry vat displaces cooking oil, thereby raising the level of cooking oil in the fry vat particularly since the product is held below the cooking oil surface during a cooking cycle Preferably, to ensure the workstation reliability and system uptime, extensive control redundancy can be provided. As a result, the control subsystems for each Fryer Module vat and each Dispensing Module chute are designed and constructed as individual units that operate even if one or more subsystem fails

Additionally, the control of the Dispensing Module freezer environment and operation can be an independent subsystem

Preferably, the Control System includes the capability to operate all modules individually This allows the operator to disconnect and remove a module from the network and operate the remaining modules in a semi-automatic method, manually performing some of the operations Preferably, there are controls on each module that permit an operator to operate that module's functions locally

Orders for product are preferably processed sequentially as they are received, although the specific products within a customer order may be arranged in a logical manner as desired The Monitor will display all products being processed by the workstation from the time the order is received until it is removed from the workstation The status of each product that is ordered can be tracked in its various stages including, for example, on order, packaged and ready to pick up, ready to manually package, and held too long

Preferably, products in the process of being fried can also be tracked, and cooking times for each basket in each wheel will count down to when product is ready to package

Master Controller

In one embodiment, the Master Controller **110** hardware may suitably comprise, or equivalent:

Intel Pentium III (or higher) with 1 0 GHz (or higher) CPU
Ethernet network interface and hub
256 MB (or more) system RAM
20 GB (or more) hard disk drive
Touch-Screen Monitor Interface
Plug and Play Touch-Screen Monitor
SCK Gateway (Ethernet)
Interconnect cabling (as needed)
Optional Keyboard and pointing device (mouse) for installation and maintenance purposes

Typical operating system software requirements are:

Windows 2000 professional (or server) SP4 or higher
A suitable Database Server, such as Fast SCK Version 3 0 (or higher) from Fast, Inc of Stratford, Conn
Fast SCK Version 3.0 (or higher) Utility Applications (SCK Editor, SCK Engine, SCK Events, and SCK Site Editor) from Fast, Inc

The Subsystem Interface Modules provide the functionality to communicate specific control events (information) conditions, and/or commands to and from the Master Controller These modules typically can be incorporated into the circuitry of controller boards In cases where the network needs to interface with a control subsystem (such as PLCs, for example), appropriate imbedded memory interface (input-output) circuit cards known in the art can be utilized All of the foregoing hardware and software or equivalent is readily available or can be produced by those skilled in the art

Fryer Controller

The frying of the frozen product is controlled by a combination of cooking oil temperature and the time the

frozen product is immersed in the cooking oil. Frying is accomplished by moving the frozen product through the heated cooking oil by a rotating fry wheel. As previously described, a programmable stepper or other motor can provide the desired precisely controlled movement of the fry wheel

The following Table I lists typical control parameters and several optional parameters that can be used, if desired

TABLE I

Fryer Module Control Signals
(One set for each of 4 Product Lanes)

Description	Input	Output	Op Adj
Set Temperature	X		X
Actual Temperature		X	
"Ready" Band Width		X	
Temperature Offset	X		
C or F	X		X
Probe #1	X		
Heater Relay #1		X	
Total Cook Time	X		X
Jog Speed	X		
Jiggle Time	X		
Cleaner Level		X	
Oil Fill		X	
Cleaner Fill		X	
Probe #2	X		
Heater Relay #2		X	
Flex Time	X		

FIG. 71 depicts a typical motor/fry wheel/basket cycle Virtually every parameter can be fixed or adjustable as desired For example, during one typical cycle, which may be for a preset period of time that is one-quarter of the cooking time for food contained in a compartment, fry wheel **410** is rotated clockwise 45° in the direction of arrow K of FIG **13** After some period of time after the 45° incremental rotation, a basket shaking simulation of back and forth rotation occurs over a period of about two seconds After a 0 to 10 second delay, another basket simulation shaking occurs Thereafter, a period of time ("Basket Load Window") is available for loading another compartment, such as compartment **436** with a charge of French fries or other food to be fried Thereafter, a "no load zone" or relatively short period of time towards the end of the cycle is set aside just prior to another 45° fry wheel **410** rotation in the direction of arrow K, which commences another cycle During each cycle, three "home routines" can be employed, one after each rotation of fry wheel **410** to accurately locate fry wheel **410** so that it is properly positioned with the upper end of compartment bottom **508** of one of fry wheel **410** compartments adjacent discharge **498** and another of the compartments properly aligned to receive a charge of French fries or other food to be fried, such as from food dispensing device **200**

To ensure proper operation of the basket/fry wheel, including positioning the unit precisely for smooth loading and complete unloading, the basket/fry wheel position must be constantly synchronized To do this, a "homing" sensor circuit can be utilized that resets the home position after every move of the wheel This sensor preferably is electromagnetic and is impervious to dirt and grease build up and has no moving parts although any suitable sensor can be used

Dispensing Controller

The Dispensing Module control system **114** separates functions by the product delivery lane they support In one embodiment, where there are four delivery lanes, there are four control subsystems Each subsystem controls a vibrating product conveyor, a portioning load cell, and a dump actuator Additionally, there are optional module configurations that affect the controls design If lanes **1**, **2**, and/or **3** are configured with bulk food hoppers, a product level sensor can be provided to alert operators to reload frozen product before the hopper is empty If each of lanes **2**, **3** and/or **4** are configured with an array of coil magazines for food items, the controls must sequentially switch power to each of the motors in the lane to maintain a constant flow of frozen product

Table II lists defined control signal parameters for each of the Dispensing Module Lane controllers:

TABLE II

Dispensing Control Signals
(One set for each of 4 Product Lanes)

Description	Input	Output
Load - Small Qty	X	
Load - Large Qty	X	
Load Coil A	X	
Load Coil B	X	
Load Coil C	X	
Load Coil D	X	
Load Coil E	X	
Ready to Dump		X
Vibrator Frequency	X	
Bulk Fill Level		X
Time Out		X
Overweight		X
Clean Out	X	

Freezer Controller

In addition to properly dispensing products into the Fryer Module, the dispensing device **200** control **114** must also maintain a proper frozen environment for all products To accomplish this, another controller subsystem can be provided Table III lists the applicable control signal parameters for the freezer subsystem A safety circuit interrupts all dispensing activity when the aisle door is opened

TABLE III

Freezer Control Signals

Description	Input	Output	Op. Adj
Set Temperature	X		X
Actual Temperature		X	
Aisle Door Open		X	

The separation of the Dispensing Module controls into these five subsystems when there are five makes for a convenient mechanical arrangement in the base of the module, and allows for the required flexibility given the configuration options

In one embodiment, for manual operation, four "dispense" buttons are provided, one for each lane One button would cause the release of a pre-set portion of the frozen product for that lane The controls preferably should be located so the operator could by visual observation determine the appropriate Fryer basket to make sure the product dispenses into the proper basket

Packaging Controller

Packaging Controller **118** for the Packaging Module incorporates several event signal generators for the control system to sense or read The main Packaging Module or device **600** elements are depicted in FIGS **25-29** In one embodiment, the Packaging Module or device control sys-

tem includes two subsystems within the Packaging Module, the packaging subsystem and the heated food storage device **635** that can be used in place of packaging device **600**

The Packaging Subsystem

The packaging control subsystem initially interfaces with the Packaging Module PLC and sends packaging device **600** a signal to start the sequential operation of packaging one of an appropriately-sized portion of French fries. The actions and reactions of all the electromechanical devices (e g., container handling system **610**, dispensing member **606**, overflow member **613**, load cell **702** and chute mechanism **608**) can be, if desired, sequenced and controlled by the local on-board controller (i e , PLC) and not Master Controller **110**.

Once the automated arm **764** sets the filled package of fries on conveyor **614** and the receptacle load gate **926** opens to allow receptacle **612** to move to the pick up area, a signal will be sent back to Master Controller **110** indicating that the particular order of fries is ready for pick up Until that receptacle **612** moves to the return gate **928** (located at the operator right front of the Packaging Module) and the gate permits receptacle **612** to move therepast after receptacle **612** is empty, Master Controller **110** will believe (and display) that the order of fries is waiting to be picked up Preferably, the crew member will pick up fries from right to left to ensure that the order sequence is followed and that the oldest fries are served first

Because the number of receptacles **612** that can fit between gate **926** and return gate **928** typically is limited, Master Controller **110** intelligence preferably keeps track of how many orders of fries are in the pick up cue This allows audible/visual alerts to be triggered on the Monitor to remind the crew that orders have been waiting Also, even if orders are picked out of sequence, the Master Controller will remember what was on an empty receptacle **612** and clear it when it passes return gate **928**

Preferably, the Master Controller is configured to remember the hold time of each packaged fry order If the order has not been picked up in time, the Monitor will alert the operator by audible/visual signal to "waste" that order

The Secondary Loop

The remainder of the Packaging Module or device **600** control **118** functions address the secondary loop, "buffer inventory replacement" Preferably, there are two typical system requirements for the buffer inventory: (1) there must be a minimum amount of fries in member **606** or chute mechanism **608** to completely fill the next packaging order (that is, one portion of a given size); and (2) the buffer inventory is low and needs to be replenished

For the first requirement, if there is insufficient buffer inventory to fill the package, chute mechanism **608** is disabled and an error message alarm is sent This condition should not happen, but the control intelligence prevents packaging device **600** from under filling an order

During normal operations, the level of fries in the buffer inventory will drop to a level where an inventory replenishment order will be initiated In that event, Master Controller **110** can signal dispensing device **200** to start its fill sequence. This process should typically start soon enough that the replacement product can be fried, salted, and added to the dispensing member **606** before the "out-of-product" condition is reached. The KMS data can be integrated into the Master Control intelligence to help insure that there is replacement product in process before the actual need arises. This capability minimizes order delivery delays while also preventing the dispensing member **606** inventory growing beyond actual need

The dispensing member **606** inventory can be managed in a number of ways, as desired. For example, any of the following can be utilized and implemented by one of ordinary skill in the art: (a) direct sensors; (b) a load cell that constantly weighs the buffer inventory; and (c) a dynamic empirical calculation

The dynamic empirical calculation embodiment uses the Master Controller to constantly calculate how much product has been added to dispensing member **606**, and subtract out the portion packaged, any bonus amount, waste, and a safety factor This empirical total will then be compared to pre-set "reload" levels The formula may also include how much product is in process In all cases, the buffer inventory level can be adjusted during the day to reflect actual sales levels

The controls system design for all other (i e , non-salted French fries) products is that the same control process would be used, but that the "buffer inventory" for those products would be defaulted to zero That is, an order for hash browns would immediately signal an "out-of-inventory" condition and launch an "inventory replacement" command to the dispensing device **200** Later, if the need arises, controller intelligence would allow the operator to utilize some buffer inventory for these products

Optionally, a provision can be made for unsalted French fries Unsalted French fries would be handled like the non-French fries products. When an order for unsalted French fries is received, Master Controller **110** will signal the Packaging Module to move diverter bar **605** The next load of French fries coming from the Fryer Module will then be diverted to a portion of chute **604** of packaging device **600** for manual packaging The extra unsalted fries can be manually returned to chute **604**

An important feature of the automated system is to maintain product integrity One facet of that is to dispose of product that has exceeded its authorized holding time Master Controller **110** will remember when each load of French fries came out of fry device **400**. The mechanical design of packaging device **600** assures a substantially "first in—first out" product movement. How long the "oldest" fries have been in dispensing member **606** is tracked by Master Controller **110** or packaging device controller **118**, as desired. Whenever the allowable holding time has been reached, Master Controller **110** will signal the Packaging Module subsystem Controller **118** to start the buffer waste cycle (or the packaging device Controller **118** can directly control this function) It is possible that some French fries in the buffer will not have reached their limit, but through control parameter refinement, this can be minimized Table IV lists the control signals for one embodiment of the packaging control subsystem:

TABLE IV

Packaging Control Signals

Description	Input	Output	Op Adj
Package #1	X		
Package #2	X		
Package #3	X		
Package #4	X		
Divert Fries	X		
Produce #5	X		
Produce #6	X		
Produce #7	X		
Produce #8	X		
Produce #9	X		
Dump Buffer	X		
Buffer Low		X	

TABLE IV-continued

Packaging Control Signals

Description	Input	Output	Op. Adj
Buffer Full		X	
Receptacle Loaded		X	
Receptacle Empty		X	
Time out - System 610		X	
Product #5 - 9 Picked		X	

Holding Controller

The other control subsystem is that dedicated to holding product at proper temperatures. Generally, a standard temperature controller with timer channels to manage all holding functions can be utilized, as is known in the art.

Table V lists the various control parameters for the holding control subsystem for food holding device **635**:

TABLE V

Holding Control Signals

Description	Input	Output	Op. Adj
Buffer Temp Set	X		X
Buffer Temp Act		X	
Pick Up Temp Set	X		X
Pick Up Temp Act		X	
Apron Temp Set	X		X
Apron Temp Act		X	
Holding Temp Set	X		X
Holding Temp Act		X	
Holding Time #1 Start	X		
Holding Time #1 End	X		
Holding Time #2 Start	X		
Holding Time #1 End	X		

Touch-Screen Monitor

The Touch-Screen Monitor is the primary system user interface and can be considered part of the Master Controller configuration. The Monitor has four main functions: (1) display the status of fried foods orders; (2) allow the operator to manually control the system; (3) alert the operator to any needed manual intervention; and (4) allow the operator to reconfigure the workstation and/or change the individual operating parameters.

The Monitor display can be configured as desired. Preferably, the main display menu is simple, uncluttered and only presents the basic information needed to track ongoing order status. A sample Monitor display layout is shown in FIG. **72**.

In the illustrated embodiment, products on order would appear as horizontal rows of the appropriate product (type and portion size) icon, reading from the left edge of the screen. All products from a single POS customer order would appear on a single line. As additional POS orders are entered, the screen would refresh, moving the older orders down a line. Products on order, and not yet ready for pick up would appear as gold icons.

Across the bottom of the screen would appear the same number of locations as there are packaging device **600** receptacles **612** in the pick up zone. As packages of fries are placed on receptacles **612** and the receptacles **612** travel within the pick up zone, the appropriate icon will disappear from the "on order" line and reappear as a green icon in the spot where its receptacle is. When a package is removed from a receptacle and that receptacle passes return gate **928**, the display icon will disappear from the screen.

In one embodiment, should the "hold timer" for a packaged product expire before it is picked up, its green icon will change color (i.e., to red) and/or flash. In another embodiment, an audible alarm can be provided as well, indicating clearly that this product should be wasted.

Across the top of the screen is a line of control "buttons." There can be one for each product (again, type and portion size). The system is programmed so that touching the button on the screen will enter an order for one each of that product. There is also a screen button at the upper right corner of the screen that enables the operator to change the screen display to the "Settings" screen.

The "Settings" screen layout is depicted in FIG. **73**. From this screen, the operator may now configure all the operating settings for the product to be run in each product lane. The individual settings may include dispensing load size(s), fry vat temperature, cooking cycle time, buffer inventory level, packaging device Module heater setting, and other settings as desired. In this embodiment, all settings for a particular product are linked to that product. The operator can merely scroll in each product lane and signify the product that will be run in it. Master Controller **110** will then set all operating parameters for that product. If it is necessary to check or adjust an individual control setting (such as cook time), the operator can scroll through the items in the "settings" box for that lane and product. Then, using the "up" and "down" keys, readjust the setting and press the "enter" key to reset.

If required, a secure "manager only screen" can be configured to allow someone to adjust and/or reset selected operating parameters. Access to this screen and these settings would require some type of password to prevent any non-authorized store employee from changing basic system parameters.

Operator alert messages or alarms (e.g., bulk product low—refill now; "bridging/time out"—clear lane **2**; etc.) will appear as an "error message box" in the center of the screen, along with some type of audible alarm.

While the invention has been described with respect to certain preferred embodiments, as will be appreciated by those skilled in the art, it is to be understood that the invention is capable of numerous changes, modifications and rearrangements and such changes, modifications and rearrangements are intended to be covered by the following claims.

What is claimed is:

1. A device for the automated frying of foods comprising:

(a) a fry vat for containing and heating cooking oil;

(b) at least one circular fry wheel having at least a generally circular perimeter and a plurality of compartments each having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the wheel which radial axis is disposed above a normal operating level of the cooking oil in the fry vat;

(c) a drive mechanism for rotating the fry wheel;

(d) a control system for causing the drive mechanism to periodically rotate the fry wheel back and forth through a degree of angular rotation to simulate shaking of a fry basket.

2. The device of claim **1** wherein said degree of angular rotation is in the range of from about 2 to about 20 degrees.

3. The device of claim **1** wherein the back and forth rotation in one direction is of a larger angle of rotation than the rotation in the other direction.

4. The device of claim **1** wherein the control system further causes the drive mechanism to rotate the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and out of the cooking oil for subsequent discharge of the food from the compartment.

5. The device of claim **1** wherein the fry wheel comprises a hub, a circular rim, a plurality of spokes connecting the hub to the rim and a plurality of fry baskets secured to spokes.

6 The device of claim 4 wherein the control system causes periodic incremental rotation of the fry wheel

7 The device of claim 6 wherein the periodic incremental rotation is based on 360 degrees divided by the number of compartments

8 The device of claim 1 wherein the fry wheel comprises a rim and the drive mechanism comprises a roller and means for urging the roller against the rim

9 An automated method of frying food comprising:

(a) placing food in a fry wheel compartment of a fry wheel having at least a generally circular perimeter and a plurality of compartments each having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the wheel which radial axis is disposed above a normal operating level of the cooking oil in a fry vat having heated cooking oil therein;

(b) rotating the fry wheel so that the compartment containing the food travels submerged in the heated cooking oil; and

(c) periodically rotating the fry wheel back and forth through a degree of angular rotation to simulate shaking of a fry basket while the food is submerged in the cooking oil

10 The method of claim 9 wherein said degree of angular rotation is in the range of from about 2 to about 20 degrees

11 The method of claim 9 wherein the periodic rotation in one direction is of a larger angle of rotation than the rotation in the other direction

12 The method of claim 9 wherein said rotating the fry wheel so that the compartment containing the food travels submerged in the heated cooking oil comprises rotating the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and out of the cooking oil for subsequent discharge of the food from the compartment

13 The method of claim 12 wherein the said rotating the fry wheel so that the compartment containing the food travels submerged in the heated cooking oil further comprises periodic incremental rotation of the fry wheel

14 The method of claim 13 wherein the degree of periodic incremental rotation is based on 360 degrees divided by the number of compartments

* * * * *

EXHIBIT G

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(21) Appl No: 11/156,862

(22) Filed: Jun. 20, 2005

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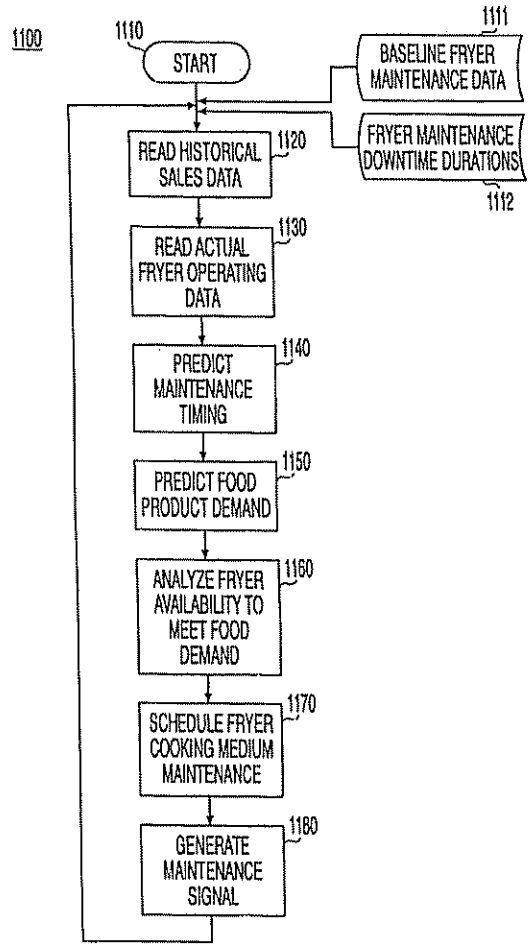
Publication Classification

(51) Int. Cl.[7] G06F 17/60; A23L 1/00; A47J 27/00

(52) U.S. Cl. 705/15

(57) ABSTRACT

The present invention provides a bi-directional communication network which provides monitoring, data collection, and control of food service industry operations The system includes a computer and control logic implemented by the computer which may be configured to perform various tasks A communication network may be provided linking the computer with equipment and appliances having a microprocessor based controller capable of communicating with the system In one embodiment, the system automatically verifies the performance of equipment-related manual tasks in food preparation In another embodiment, the system schedules the maintenance of a plurality of kitchen appliances In another embodiment, the system provides a hold timer for tracking the hold time of cooked food products and determines when the hold time elapses In yet another embodiment, the system manages the inventory of cooked food products in a food preparation establishment



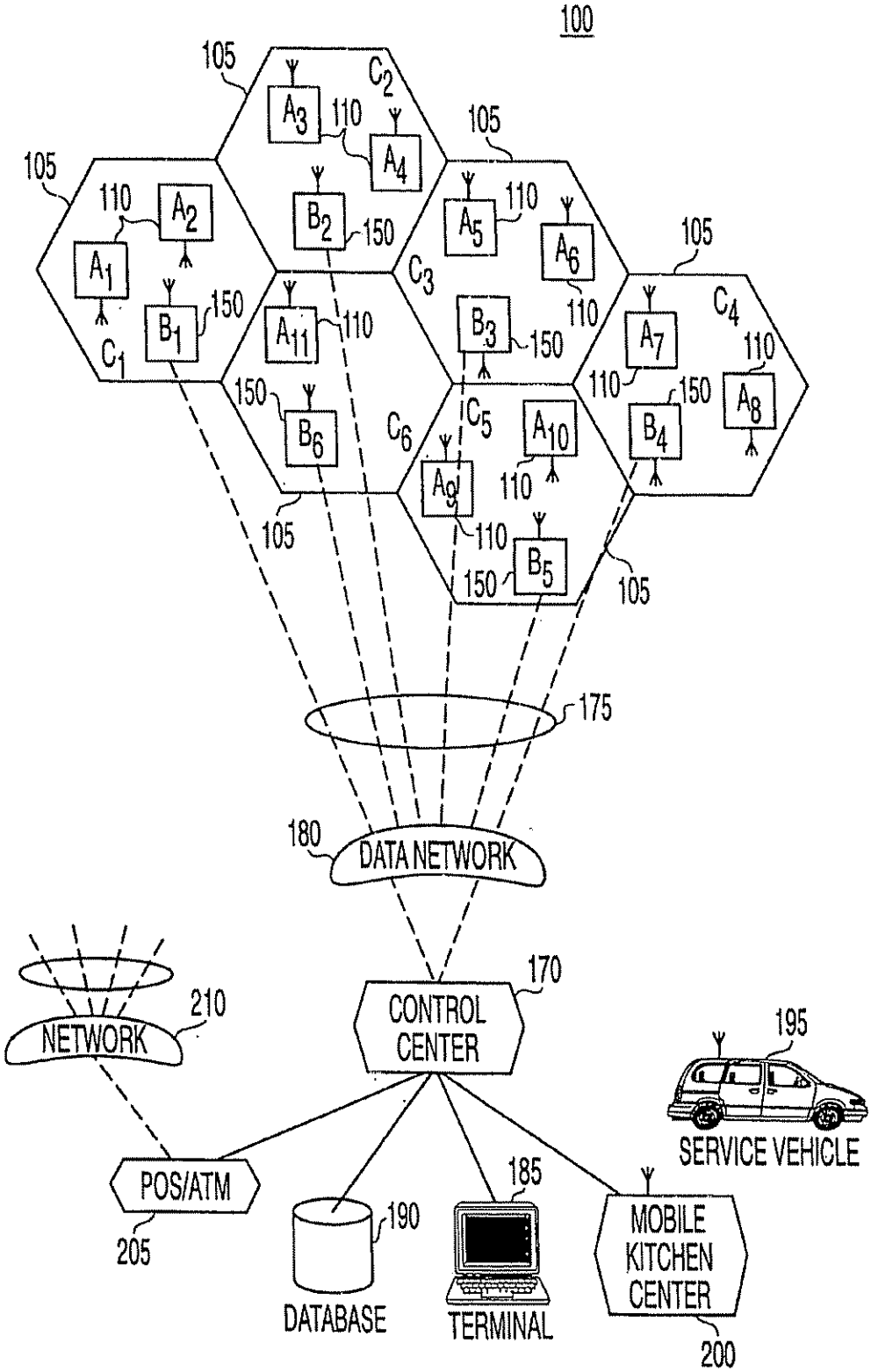

100
105
110
150
175
180
DATA NETWORK
170
CONTROL CENTER
210
NETWORK
195
SERVICE VEHICLE
POS/ATM
205
190
DATABASE
185
TERMINAL
MOBILE KITCHEN CENTER
200

Fig. 1

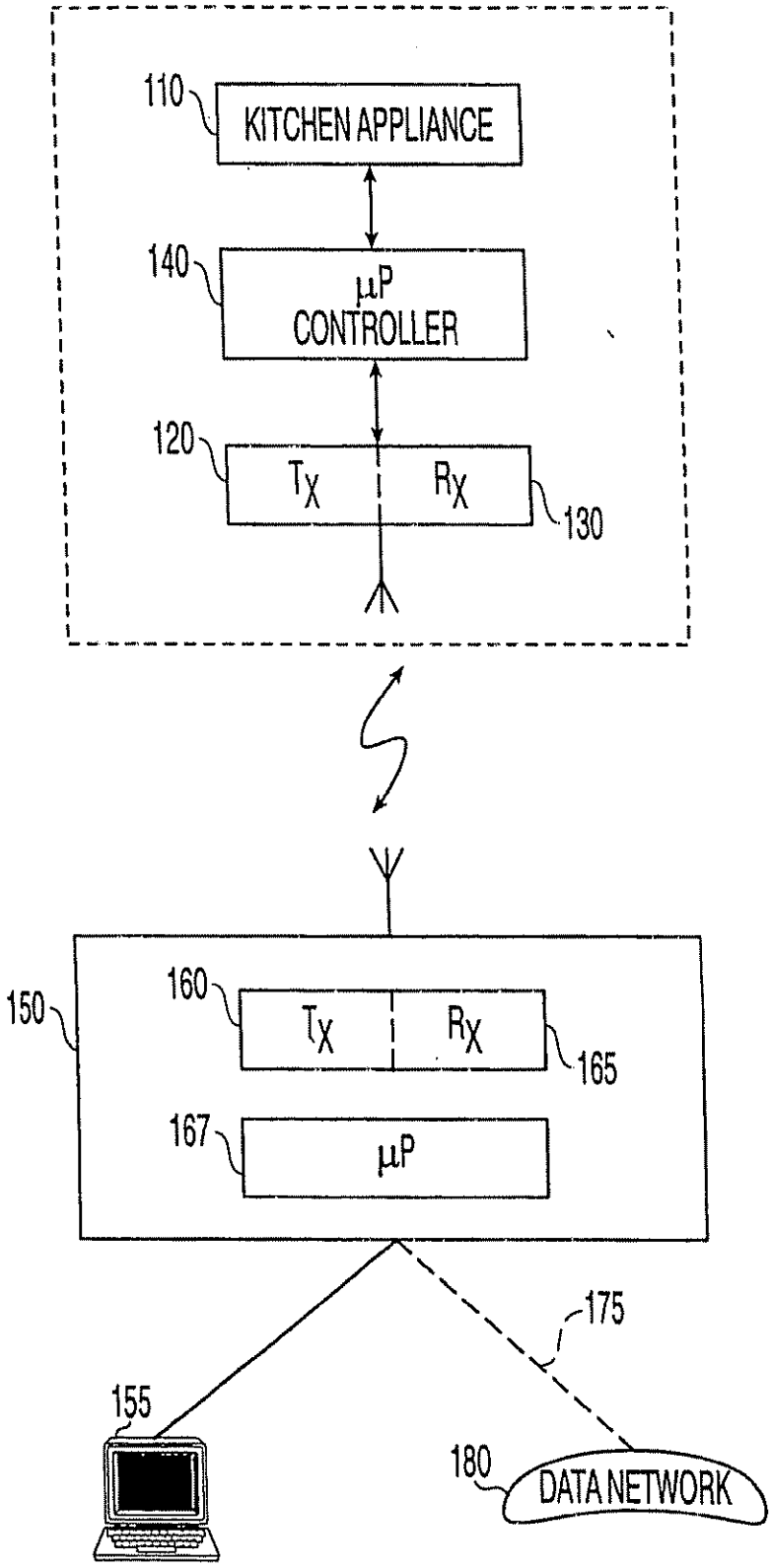

110
KITCHEN APPLIANCE
140
µP
CONTROLLER
120
TX
RX
130
150
160
TX
RX
165
167
µP
175
155
180
DATA NETWORK

Fig. 2

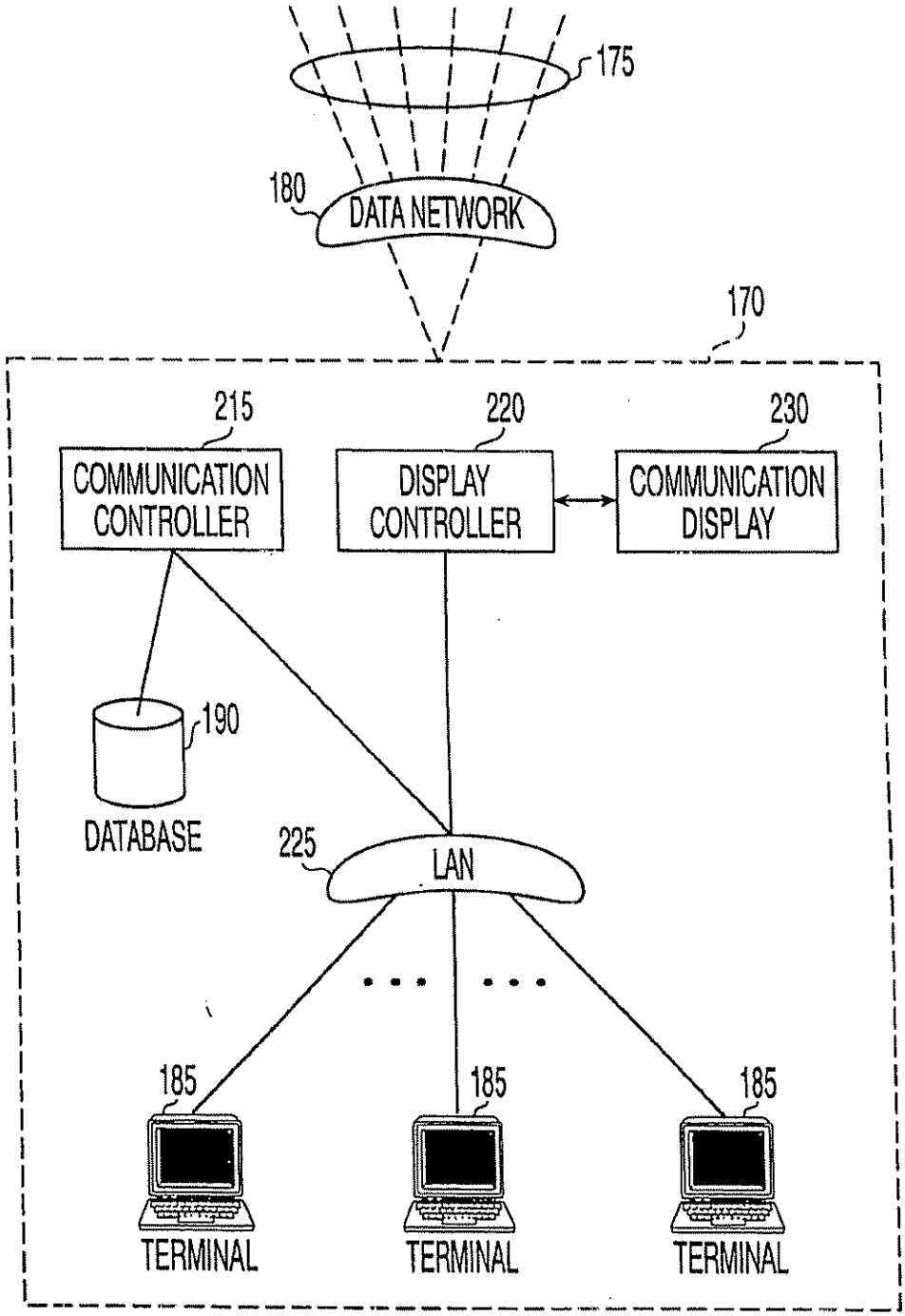

175
180
DATA NETWORK
170
215
220
230
COMMUNICATION CONTROLLER
DISPLAY CONTROLLER
COMMUNICATION DISPLAY
190
DATABASE
225
LAN
185
185
185
TERMINAL
TERMINAL
TERMINAL

Fig. 3

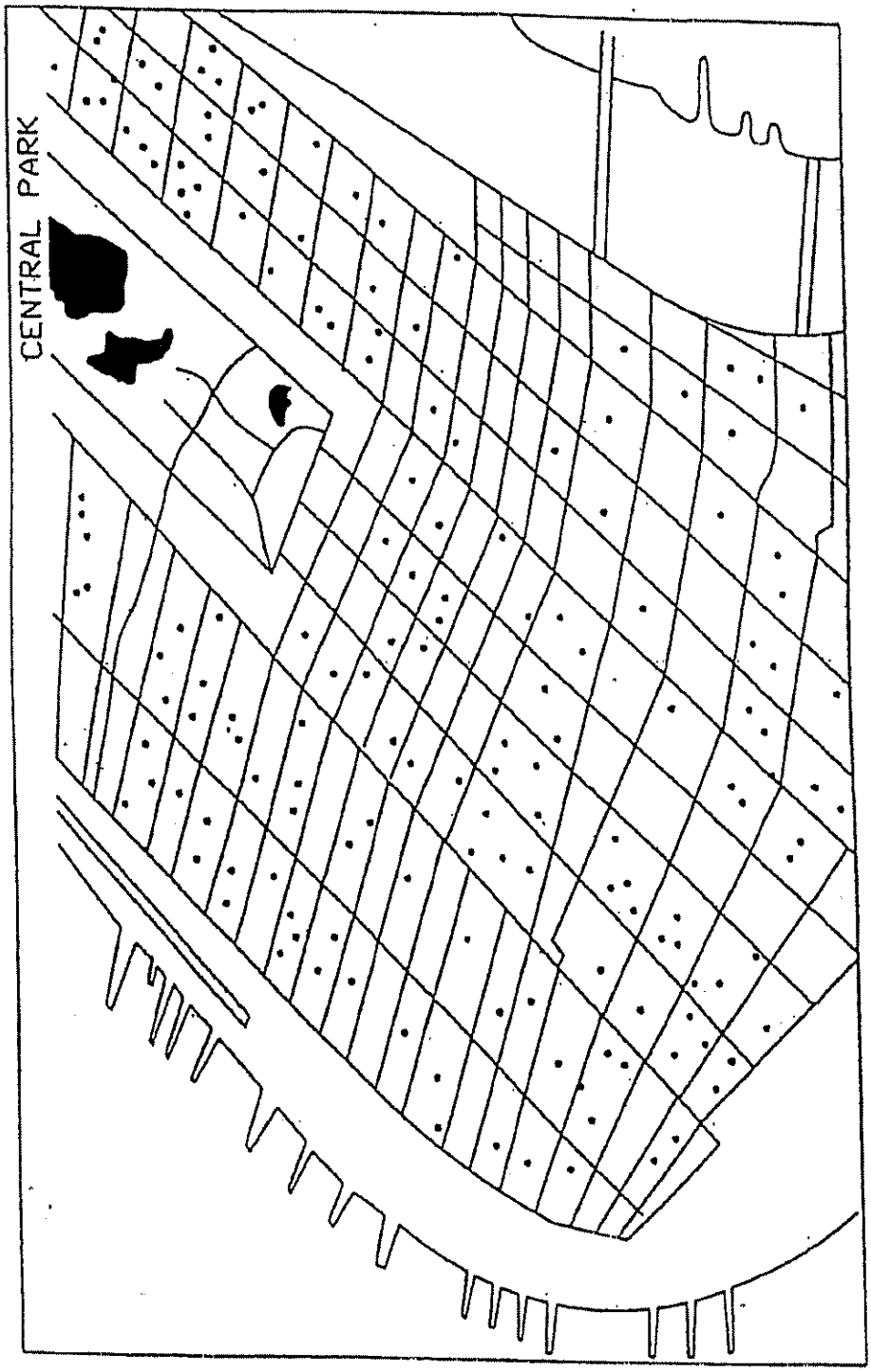


Fig. 4

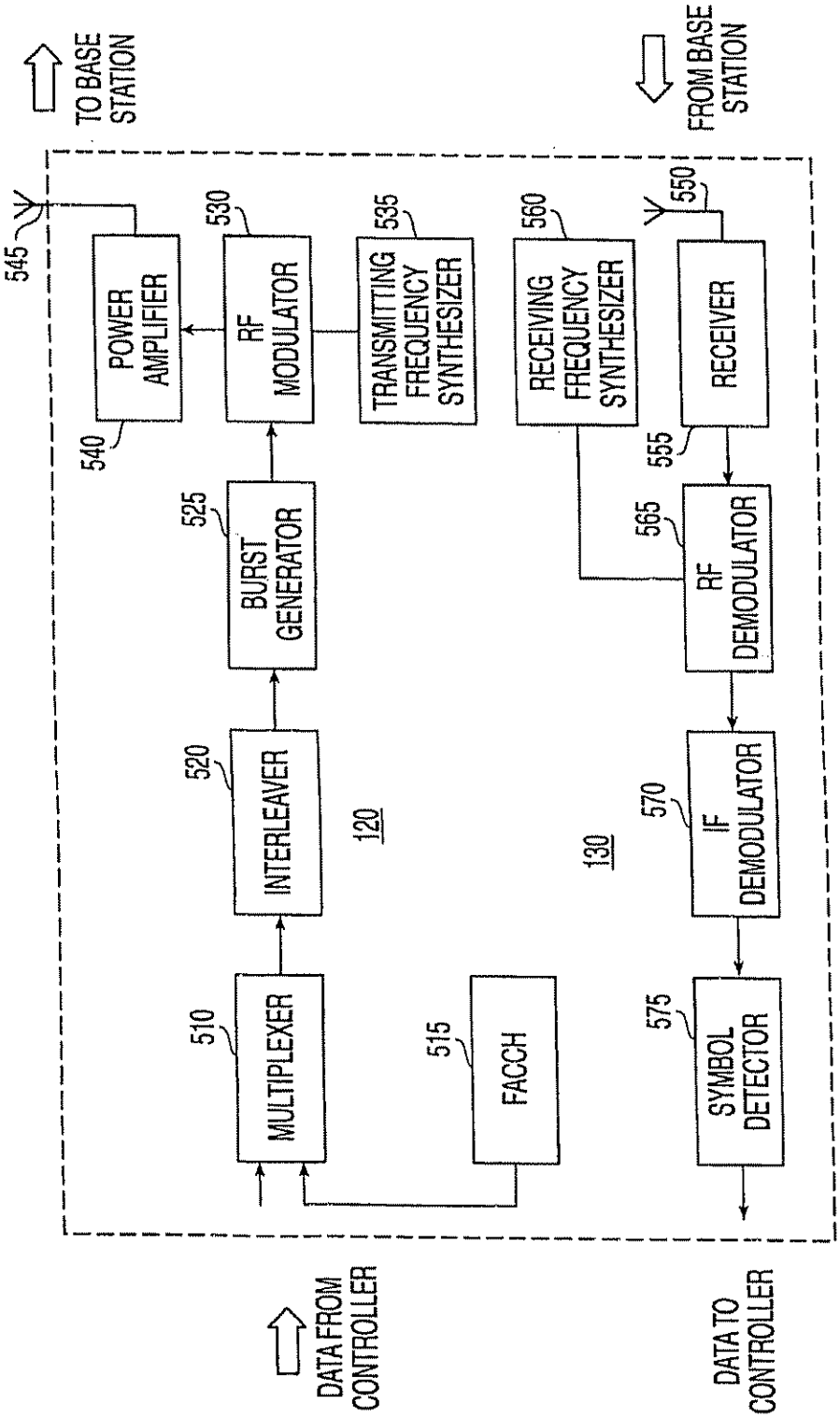

TO BASE STATION
FROM BASE STATION
545
POWER AMPLIFIER
540
530
RF MODULATOR
535
TRANSMITTING FREQUENCY SYNTHESIZER
560
RECEIVING FREQUENCY SYNTHESIZER
550
RECEIVER
555
525
BURST GENERATOR
565
RF DEMODULATOR
520
INTERLEAVER
120
130
570
IF DEMODULATOR
510
MULTIPLEXER
515
FACCH
575
SYMBOL DETECTOR
DATA FROM CONTROLLER
DATA TO CONTROLLER

Fig. 5

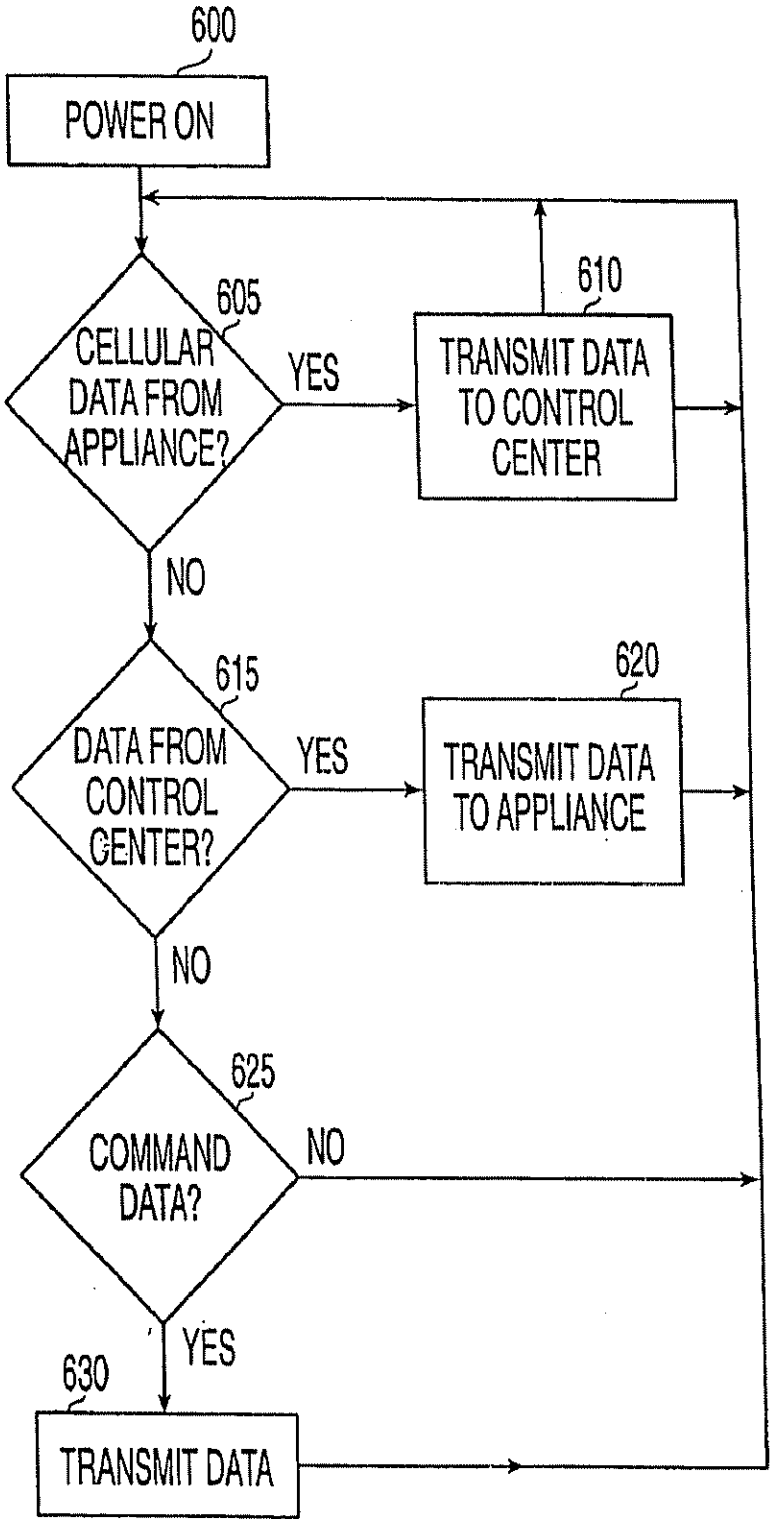

600
POWER ON
605
CELLULAR DATA FROM APPLIANCE?
YES
610
TRANSMIT DATA TO CONTROL CENTER
NO
615
DATA FROM CONTROL CENTER?
YES
620
TRANSMIT DATA TO APPLIANCE
NO
625
COMMAND DATA?
NO
YES
630
TRANSMIT DATA

Fig. 6

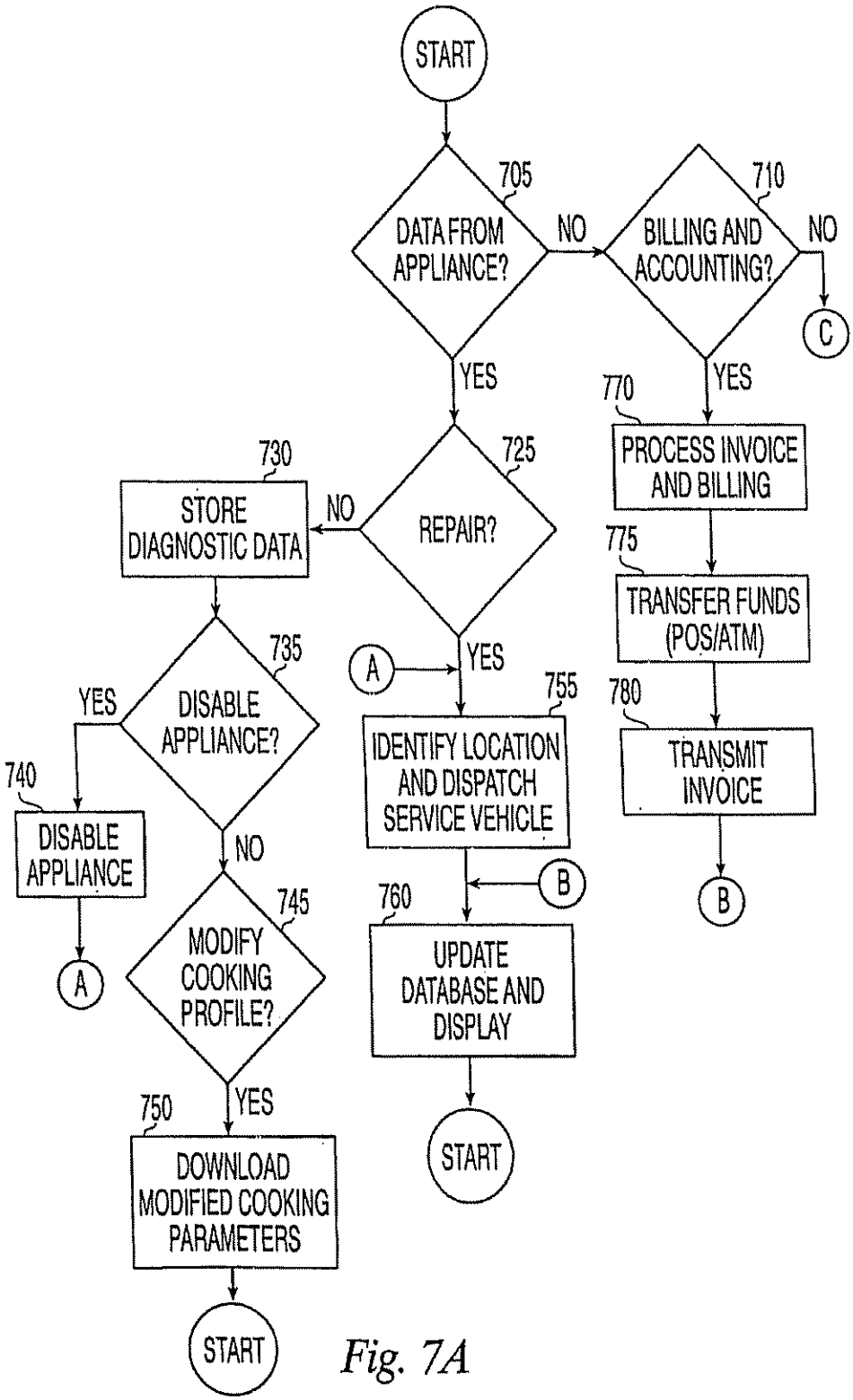

START
705
DATA FROM APPLIANCE?
NO
710
BILLING AND ACCOUNTING?
NO
C
YES
YES
770
PROCESS INVOICE AND BILLING
775
TRANSFER FUNDS (POS/ATM)
780
TRANSMIT INVOICE
B
730
STORE DIAGNOSTIC DATA
NO
725
REPAIR?
A
YES
755
IDENTIFY LOCATION AND DISPATCH SERVICE VEHICLE
735
DISABLE APPLIANCE?
YES
740
DISABLE APPLIANCE
A
NO
745
MODIFY COOKING PROFILE?
760
UPDATE DATABASE AND DISPLAY
YES
750
DOWNLOAD MODIFIED COOKING PARAMETERS
START
START

Fig. 7A

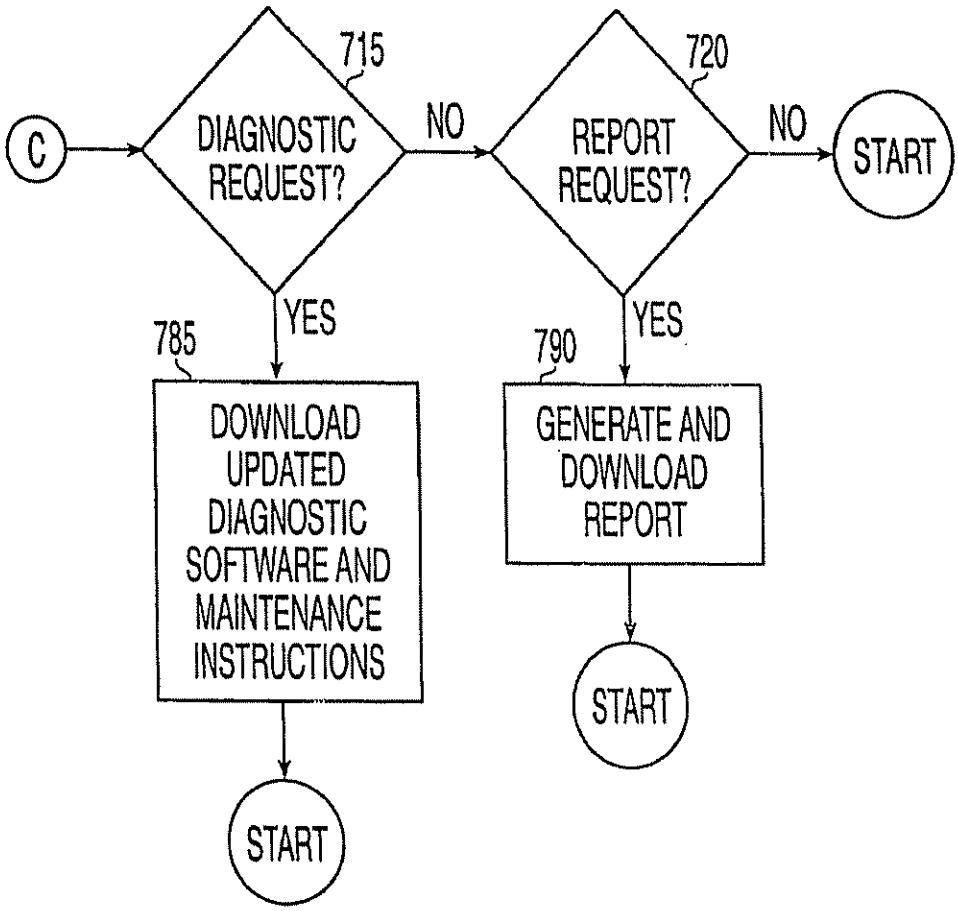

C
715
DIAGNOSTIC REQUEST?
NO
720
REPORT REQUEST?
NO
START
YES
785
DOWNLOAD UPDATED DIAGNOSTIC SOFTWARE AND MAINTENANCE INSTRUCTIONS
START
YES
790
GENERATE AND DOWNLOAD REPORT
START

Fig. 7B

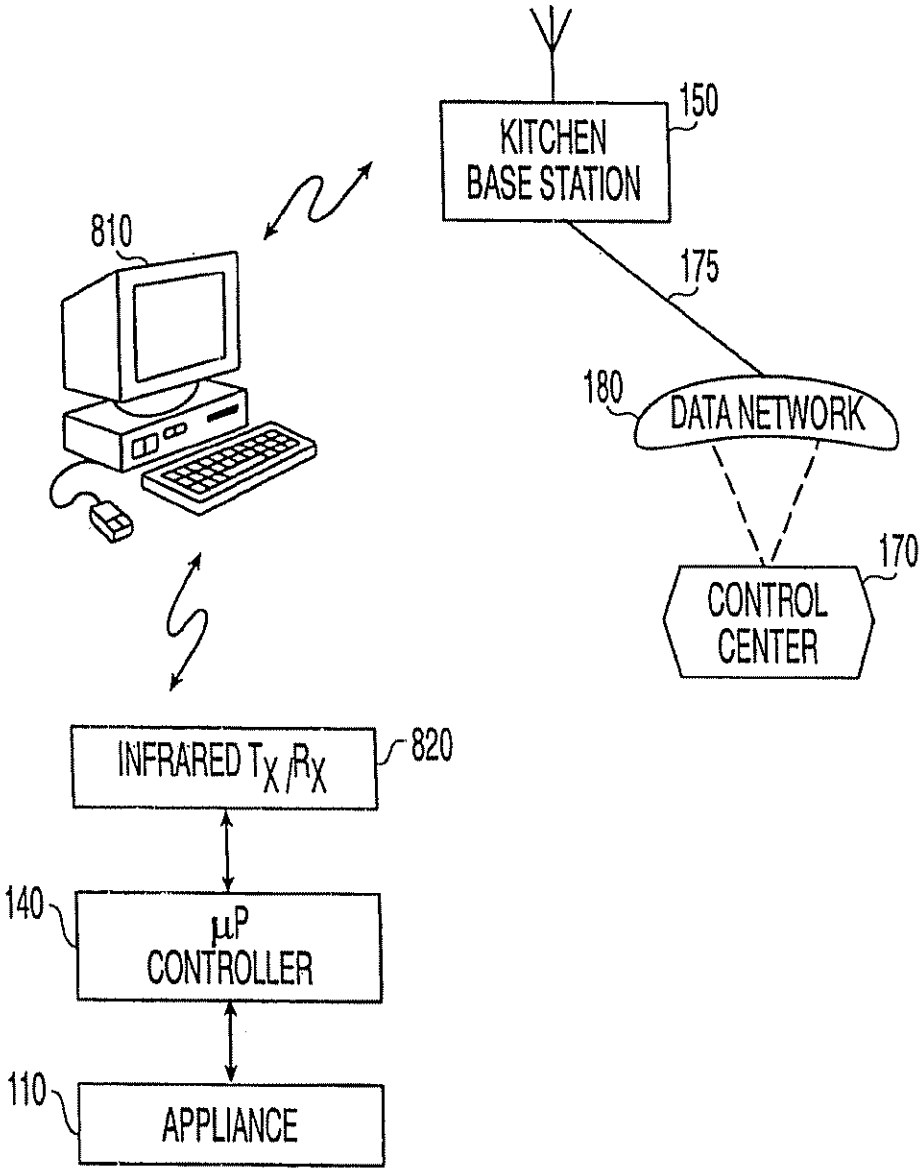

KITCHEN BASE STATION
150
810
175
180
DATA NETWORK
170
CONTROL CENTER
INFRARED TX/RX
820
140
µP CONTROLLER
110
APPLIANCE

Fig. 8

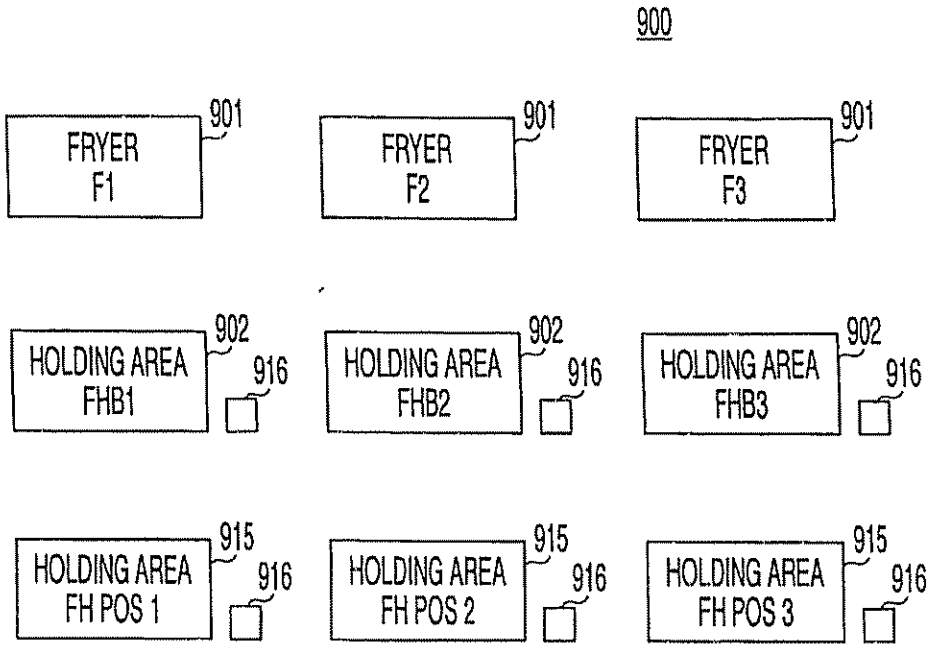

900
FRYER F1
901
FRYER F2
901
FRYER F3
901
HOLDING AREA FHB1
902
916
HOLDING AREA FHB2
902
916
HOLDING AREA FHB3
902
916
HOLDING AREA FH POS 1
915
916
HOLDING AREA FH POS 2
915
916
HOLDING AREA FH POS 3
915
916

Fig. 9A

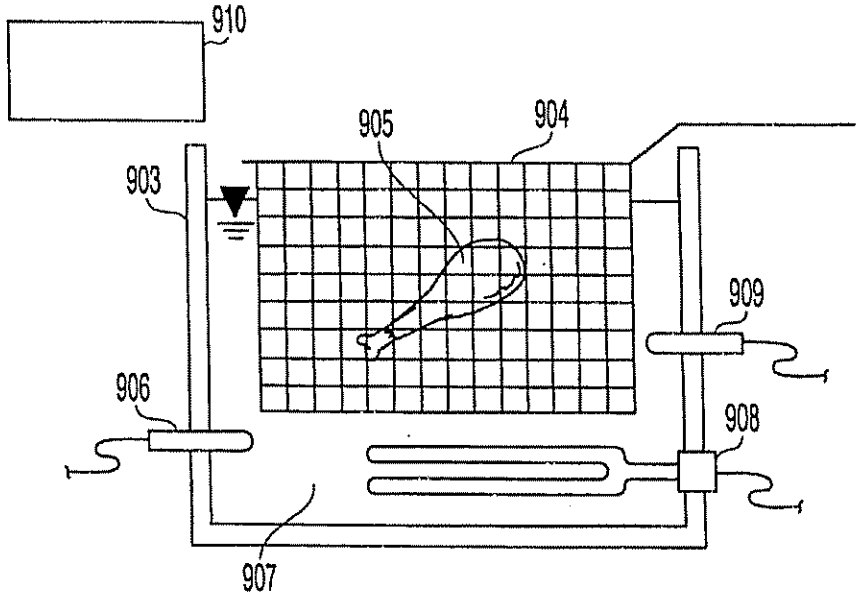

910
905
904
903
909
906
908
907

Fig. 9B

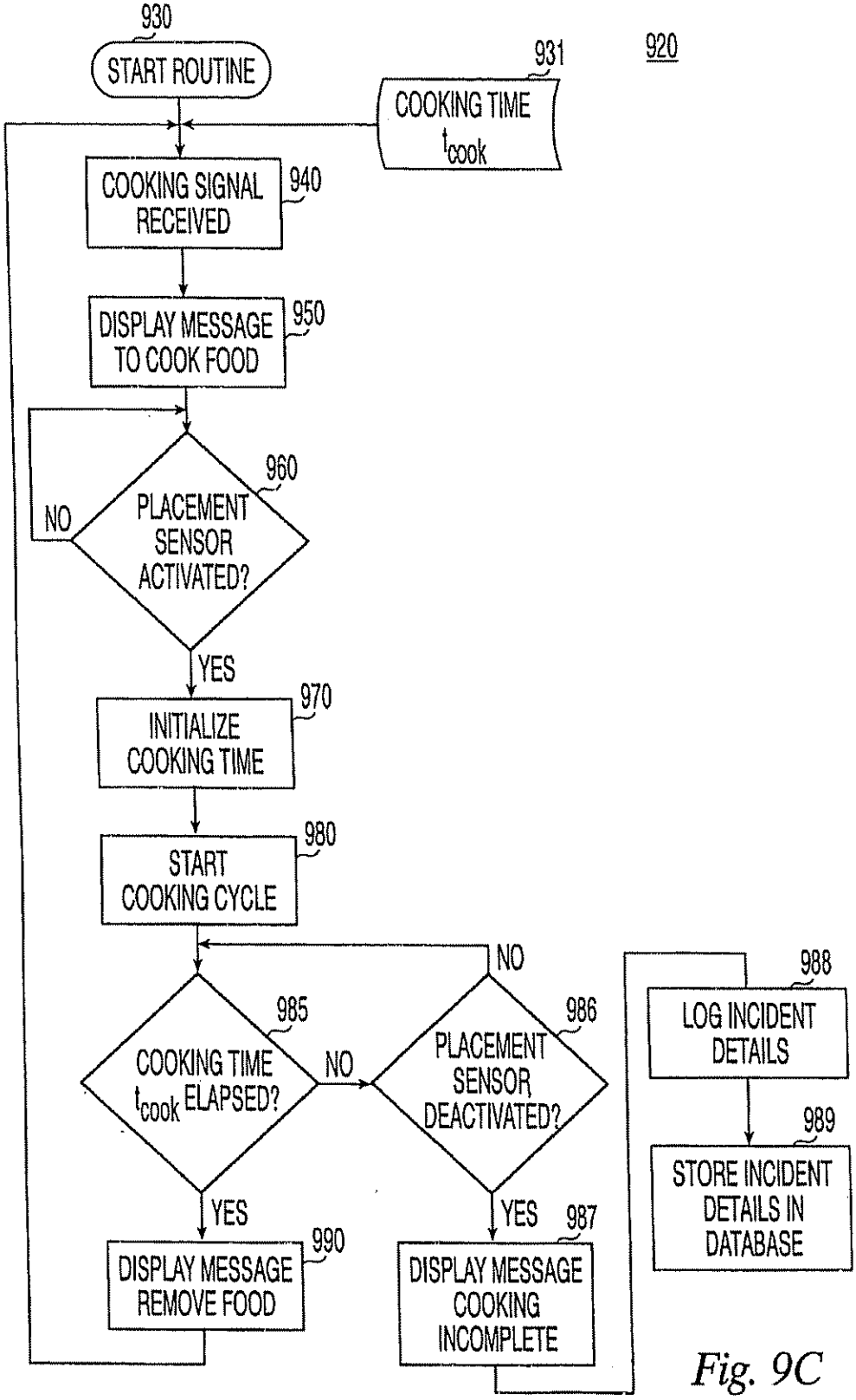

930
START ROUTINE
931
COOKING TIME
t_{cook}
920
COOKING SIGNAL RECEIVED
940
DISPLAY MESSAGE TO COOK FOOD
950
960
NO
PLACEMENT SENSOR ACTIVATED?
YES
INITIALIZE COOKING TIME
970
START COOKING CYCLE
980
NO
985
COOKING TIME t_{cook} ELAPSED?
NO
986
PLACEMENT SENSOR DEACTIVATED?
YES
990
DISPLAY MESSAGE REMOVE FOOD
YES
987
DISPLAY MESSAGE COOKING INCOMPLETE
988
LOG INCIDENT DETAILS
989
STORE INCIDENT DETAILS IN DATABASE

Fig. 9C

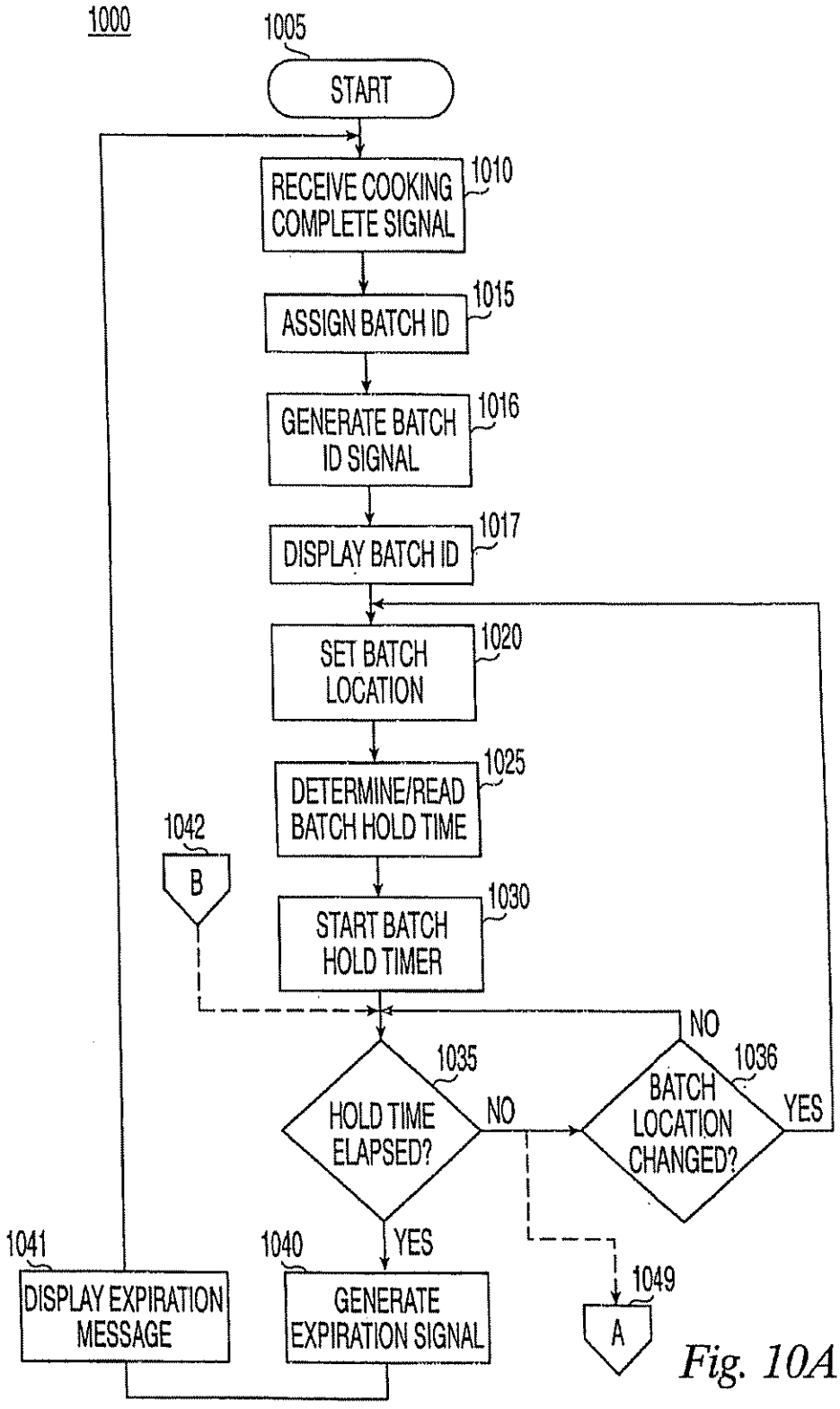

1000
1005
START
RECEIVE COOKING COMPLETE SIGNAL
1010
ASSIGN BATCH ID
1015
GENERATE BATCH ID SIGNAL
1016
DISPLAY BATCH ID
1017
SET BATCH LOCATION
1020
DETERMINE/READ BATCH HOLD TIME
1025
1042
B
START BATCH HOLD TIMER
1030
NO
1035
HOLD TIME ELAPSED?
NO
1036
BATCH LOCATION CHANGED?
YES
1041
DISPLAY EXPIRATION MESSAGE
1040
YES
GENERATE EXPIRATION SIGNAL
1049
A

Fig. 10A

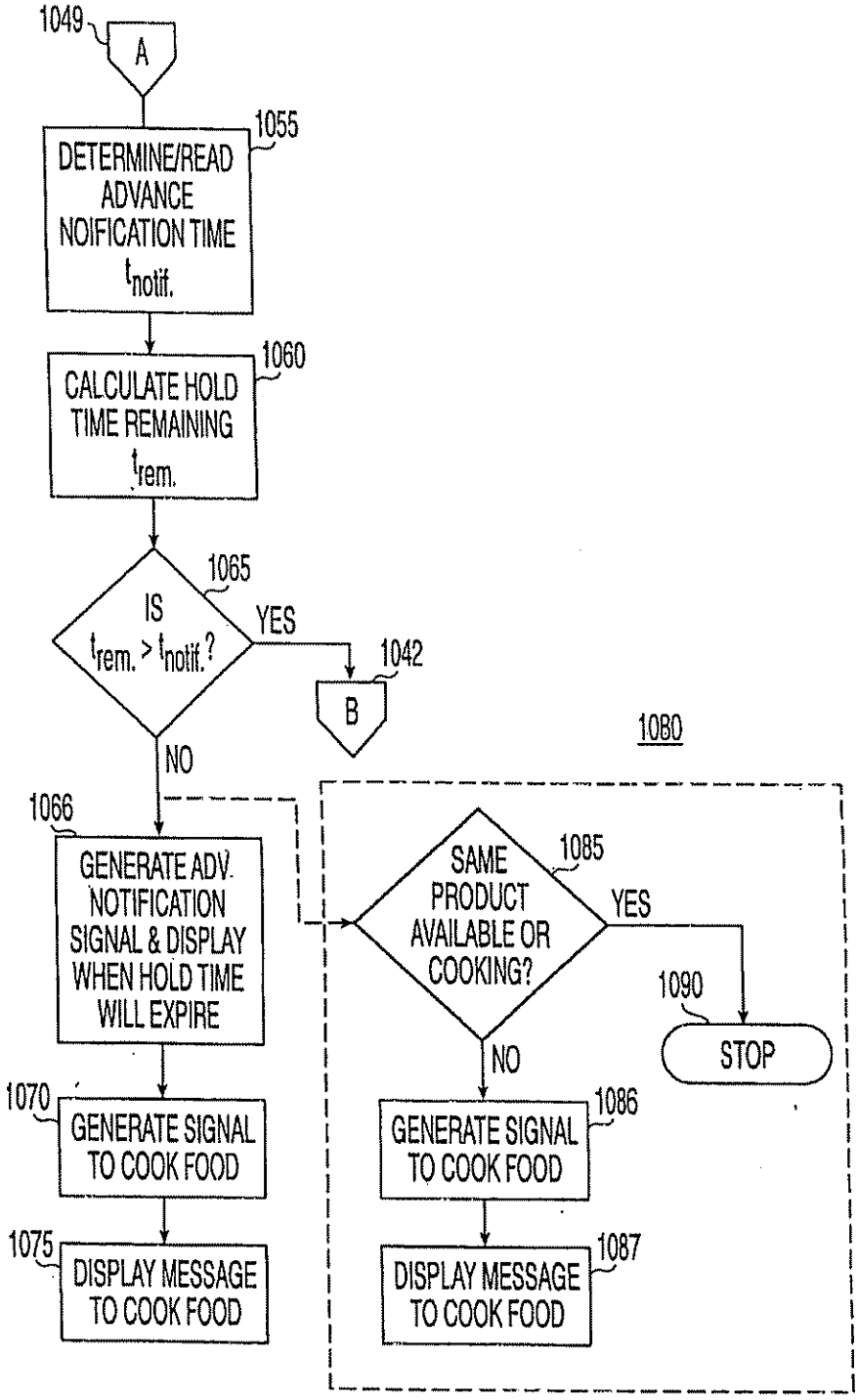

1049
A
1055
DETERMINE/READ ADVANCE NOIFICATION TIME $t_{notif.}$
1060
CALCULATE HOLD TIME REMAINING $t_{rem.}$
1065
IS $t_{rem.} > t_{notif.}$?
YES
1042
B
NO
1080
1066
GENERATE ADV. NOTIFICATION SIGNAL & DISPLAY WHEN HOLD TIME WILL EXPIRE
1085
SAME PRODUCT AVAILABLE OR COOKING?
YES
1090
STOP
NO
1070
GENERATE SIGNAL TO COOK FOOD
1086
GENERATE SIGNAL TO COOK FOOD
1075
DISPLAY MESSAGE TO COOK FOOD
1087
DISPLAY MESSAGE TO COOK FOOD

Fig. 10B

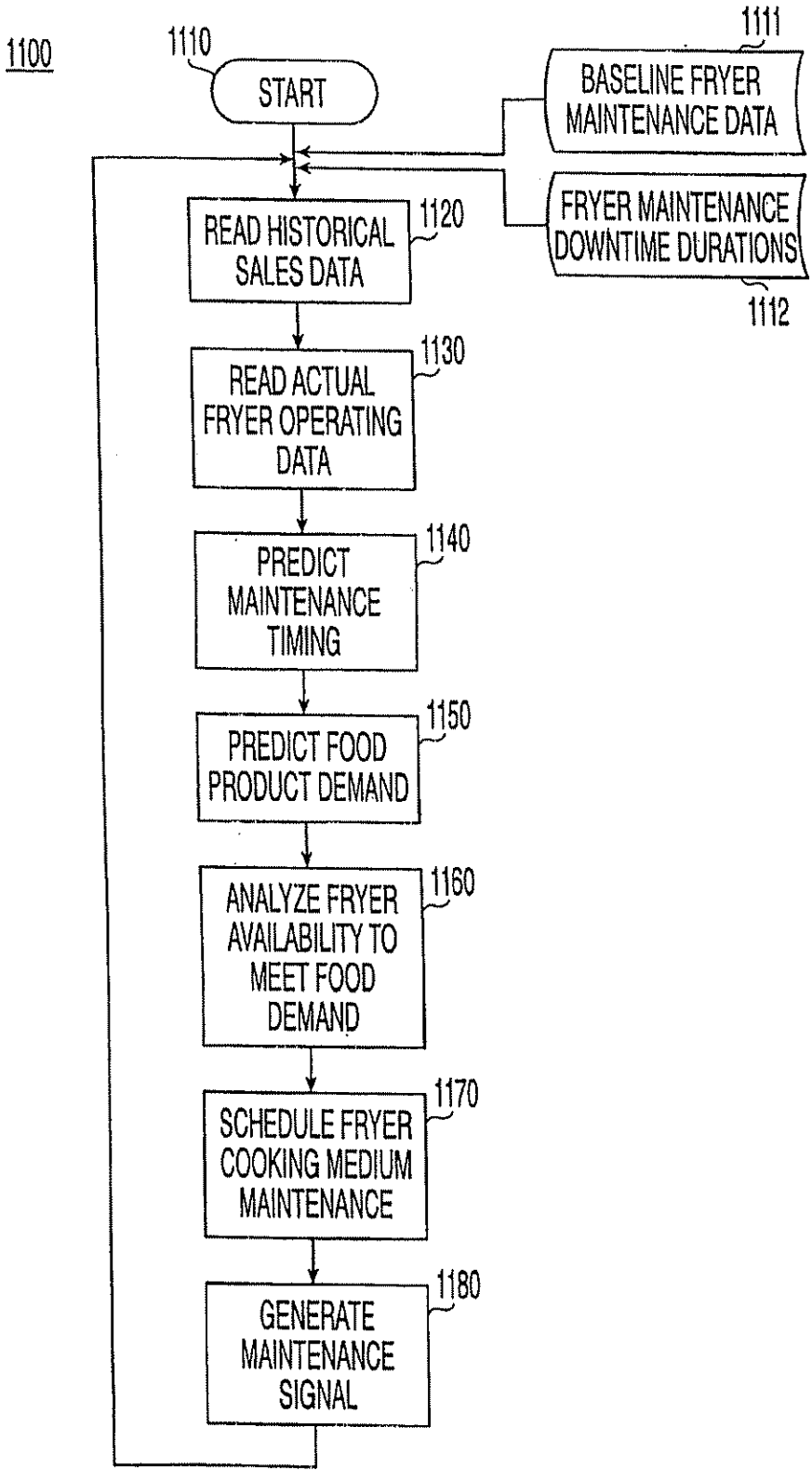

1100
1110
START
1111
BASELINE FRYER MAINTENANCE DATA
FRYER MAINTENANCE DOWNTIME DURATIONS
1112
READ HISTORICAL SALES DATA
1120
READ ACTUAL FRYER OPERATING DATA
1130
PREDICT MAINTENANCE TIMING
1140
PREDICT FOOD PRODUCT DEMAND
1150
ANALYZE FRYER AVAILABILITY TO MEET FOOD DEMAND
1160
SCHEDULE FRYER COOKING MEDIUM MAINTENANCE
1170
GENERATE MAINTENANCE SIGNAL
1180

Fig. 11

DIAGNOSTIC DATA INTERCHANGE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This is a continuation-in-part of U S patent application Ser No 09/587,797 filed Jun 6, 2000, Pat No XXX1 entitled "Smart Commercial Kitchen Network", which was a continuation of U S patent application Ser No 09/083,671 filed May 22, 1998, Pat No XXX2 entitled "Smart Commercial Kitchen Network", which was a continuation of U S patent application Ser No 08/643,207 filed May 2, 1996, Pat No 5,875,430 entitled "Smart Commercial Kitchen Network", which are incorporated herein by reference Also, the present application is related to commonly assigned U S Pat No 4,812,963 entitled "Plural Cooking Computer Communication System," and U S patent application Ser No 08/501,211 filed Jul 11, 1995, Pat No 5,723,846 entitled "Multiprobe Intelligent Diagnostic System For Food-processing Apparatus," which are incorporated herein by reference

TECHNICAL FIELD

[0002] The present invention relates to a communication network and, more particularly, to a communication network, such as a cooking computer communication system, for monitoring and controlling the activities of commercial kitchen or restaurant appliances, and for providing bi-directional communication between such appliances and a control center Such kitchen or restaurant appliances, for example, includes deep vat flyers and various types of ovens, and cooling systems, such as refrigerators and HVAC systems, as well as other related food processing systems found in today's restaurants and fast food chains

BACKGROUND OF THE INVENTION

[0003] In recent years, as cooking and restaurant appliances in large hotels or institutional kitchens have become more complex, there has been an increased need for the utilization of computers for diagnosing malfunctions Today, cooking appliances are maintained and serviced, however, by a food service industry—that with exceptions—is too poorly equipped and untrained to do so The domestic food service industry is composed of some three hundred independent service agencies, ranging in size from one up to hundreds of employees Most, however, consist of just a few employees which are unfortunately burdened with the responsibility for preparing invoices, repairs, inventories, warranties, credits, returns, and the like For example, these service agencies not only have to generate invoices, but also have to collect payment, which for obvious reasons is time consuming With such other duties, service agencies have little time to keep up with the technology of today's complex kitchen or cooking appliances With the existing food service industry so fragmented and ill-suited to handle administrative tasks as well as appliance repairs, it is estimated that their efficiency may be as low as 20%

[0004] Accordingly, there is a need in the art to provide a cost-effective system which enhances the work force utilization of today's food service industry, allowing the proper work allocation of administrative and repair skills among those best suited to perform the tasks

[0005] The food service industry is also faced with the problem of a difficult labor market There is stiff competition for good employees and not enough workers to fill open positions Supervision is difficult as well, especially for an owner/operator of multiple commercial units spread over many miles Workers may be inadequately trained, careless or may take shortcuts in completing their tasks properly Any of these problems can adversely affect food quality, level of service to the consumer, and compliance with various health and safety standards (for example, the Hazard Analysis Critical Control Point (HACCP) regulations created by the Food Safety and Inspection Service of the United States Department of Agriculture to minimize bacteria-related illnesses which can result from improper food handling, preparation, and holding) These problems plague even computerized kitchen systems, because those systems can neither independently verify that the ascribed tasks have been properly completed, nor identify employees who are cheating the system Moreover, to be competitive in today's global economy, the food service industry must gain tighter control over every process in the kitchen to combat escalating labor costs, achieve more accurate product forecasting, and realize faster and more efficient food preparation to better manage both facilities and human resources

[0006] Appliance Status/Monitoring

[0007] There is a need in today's food service industry for a system that is capable of generating computerized task lists on a real time basis instructing employees to perform needed tasks, and then guiding the employees through the required tasks These task lists could be transmitted and displayed on CRT's in the area of the restaurant where the task will be performed by the employee for easy reference The task lists may also be accompanied by audible instructions in addition to, or instead of by visual means alone Such task lists could, for example, provide timely communication between the point of sale (POS) and kitchen for placing orders Computerized task lists could also provide important training for employees (especially new trainees), which due to high employee turnover rates in the food service industry, has become especially problematic for restaurant managers who have precious little time to spare for training in the first instance Accordingly, computer generated lists could step employees through the cooking process for preparing various food items, various maintenance and cleaning procedures related to cooking appliances and other equipment, and any other required general duties

[0008] Known systems use labor management tools to generate and printout a static list of tasks to be done, for example, at the beginning of each day However, such lists do not have any real-time feedback and thus are not dynamic, and do not adapt to actual and ever changing operating conditions and requirements in a restaurant Accordingly, there is also need for a system which can update and modify task list based on sensed or measured operating conditions

[0009] Current fast-food systems typically use in-store CRTs to display tasks When a task is complete, the employee typically hits a "bump bar" below the screen to notify the system that the task is done The system then updates the CRT to indicate that task is done But this assumes that there is no "cheating" (i.e , hitting the bump bar without properly completing the task) by the employee This situation has been problematic for supervisors who in the fast-paced food service industry cannot possibly watch all

their employees constantly to ensure that tasks are actually being properly performed Furthermore, cheating by employees can have a detrimental financial impact on the fast-food and other restaurants For example, pulling food prepared in a deep vat fryer out before it is done can adversely affect food quality (e.g , taste, texture, appearance, etc) and shelf life Likewise, for example, bakers who pull products out of ovens before they are finished baking adversely affect food quality Improperly prepared food causes customer dissatisfaction and loss of repeat business which translates into financial losses for food service providers Another example where cheating adversely affects the food service industry is in the area of maintenance Employees who are lazy or busy may often seek shortcuts by simply skipping maintenance tasks, or performing them inadequately, but still hit the bump bar Known systems cannot detect and provide a sufficient check on this type of cheating Accordingly, there is a need for a system which can provide automatic verification that a required task has been properly completed by sensing various operating parameters, rather than relying only on the honesty employees alone

[0010] Virtual Hold Timer

[0011] The amount of time a food item can be held and served after it has been cooked is governed by both franchise standards and government regulations For example, the Hazard Analysis Critical Control Point (HACCP) standards established by the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA) dictates the amount of time food can be held at various temperatures after it has been cooked before it must be discarded These standards are intended to prevent illnesses caused by ingesting food products contaminated with microbial pathogens which may be passed on to consumers by improper food handling practices Therefore, accurate measurement and tracking of food "hold times" is of critical importance to the food preparation industry Once this "hold time" expires, the food must be thrown out

[0012] Current systems often use small plastic tags, for example, saying "00", "15", "30", "45", etc to represent minutes past the hour when the food expires—the tag travels with the food It is also possible to include a small mechanical or electronic timer that travels with the food Another known system uses electric or mechanical timers at each successive location; however, it is complicated to set each successive timer based on the amount of time left on the timer at the previous location These known systems have not worked well, and much food is often sold beyond its proper hold time, thereby subjecting food service operators to liability for violating HACCP standards and potentially exposing consumers to food-borne related illnesses

[0013] Accordingly, there is a need for a system that can establish an automatic "virtual" hold timer associated with each batch of food that is prepared Such a system could track the movement of each batch of food through the restaurant or kitchen, and figuratively "travel" with the food from the cooking appliance to various holding areas and the point of sale (POS) Such a system could also provide a single, continuous hold timer for each batch of food, thereby eliminating the need for kitchen or restaurant employees to set new times manually taking into account elapsed hold time from a previous cooking or hold station This minimizes the risk associated with food handlers having to physically handle timers and either misplacing them or making errors in setting successive timers Moreover, such a system could assist in controlling inventory of cooked food items by sensing that a particular batch of food being held is about to expire and then sending a signal instructing food preparers that another batch of the same product Such a system could further be linked to the POS system and historical sales data maintained by the system to determine how much of a particular food product should be cooked to meet the anticipated demand and replace the food whose hold time is about to expire

[0014] Shortening Management/Fryer Maintenance Management

[0015] The proper maintenance of deep-fat fryers is also of great concern to the operator of a commercial or institutional cooking establishment Such fryers typically use food-grade oil or shortening as the cooking medium However, the cooking medium degrades with each cooking cycle In order to ensure consistent food quality, periodic filtering and/or changing of the cooking medium is required Fryer controllers are often hardwired to demand cleaning at a fixed time each day; thus making it impossible to adapt fryer maintenance to actual operating data (such as sales conditions, number of cooking cycles, etc) Other prior art systems such as that described in U S Pat No 5,331,575 to Koether et al are directed to a stand-alone "smart fryer" in which a cooking computer is physically connected to an individual flyers Such prior art systems offer some improvement over the fixed-time fryer controllers in that they attempt to ensure that changing or filtering of the cooking medium is conducted timely and properly, based on tracking actual flyer usage and other relevant parameters such as cooking temperatures However, an individual fryer cooking computer only determines when cooking medium maintenance is required for the particular flyer with which it is physically associated, without regard for any other fryers This is problematic for restaurant management because it is not desirable to have too many fryers unavailable due to maintenance when the restaurant is busy and demand for food is highest Ideally, fryer maintenance should coincide with off-peak demand periods, or at the very least, multiple fryers should not be unavailable for service at the same time Accordingly, there is a need for a networked control system that could monitor and control maintenance of all fryers at a given restaurant location Furthermore, there is a need for a networked control system that can balance individual fryer usage and time the maintenance of all fryers at a given restaurant location to ensure that a maximum number of flyers are available for service during periods of peak food demand

SUMMARY OF THE INVENTION

[0016] The present invention provides a bi-directional communication network which provides real-time computer-aided diagnostics, asset history, accounting records, maintenance records and energy management Advantageously, such a network integrates the various work aspects of today's food service industry to insure the proper work allocation of administrative and repair tasks

[0017] The system includes a control center linked to a point of sale (POS) or automated teller machine (ATM)

system, a plurality of kitchen base stations, and a plurality of kitchen or restaurant appliances located within a site or cell(s) Maintenance and repair, once initialized, are monitored, for example, through the control center having a database with the necessary software diagnostics, accounting records, inventory records, and maintenance records for the particular appliance under service so as to integrate the various aspects of accounting, billing, repair and energy management

[0018] In a preferred embodiment, each cell is allocated at least one communication channel, preferably wireless, to effect bidirectional communication with the base stations, which in turns are interconnected to the control center over high speed data links In particular, the system monitors and tracks the maintenance and repair of kitchen appliances by means of information transmitted to and received from those appliances over the data network Such information may include cooking parameters, billing information, appliance identification, diagnostic information, and maintenance instructions, among others Direct billing is facilitated by transferring financial information among POS or ATM systems operated by various merchants and clearing house network centers

[0019] Each kitchen base station may interrogate the appliance or the appliance may request to transmit diagnostic information relating to the operating conditions thereof, which diagnostic information may be immediately communicated to the control center The control center may take action as appropriate, including, among others, downloading updated, operating and/or diagnostic software to the appliance, dispatching a service vehicle, or updating accounting and inventory information Most of the functions are automatically controlled by the control center, but may be also performed manually by a control center operator Alternatively, some of these functions may be distributed to the base stations, such, as in a distributed architecture network

[0020] In the preferred embodiment, on site repair is enhanced through the use of a portable hand held terminal linked to the appliance through, for example, a wireless RS-232 interface, such as by infrared communication The hand held terminal interrogates the appliance to diagnose abnormal operating conditions Upon effecting repair, the control center preferably prepares and transmits an appropriate invoice and effects billing through the POS or ATM system During repairs, should the hand held terminal require updated diagnostic software for the particular appliance under service, such a request is transmitted to the control center The appropriate software is then transmitted to the terminal through the communication data network In this manner, as new diagnostic tools become available for specific kitchen or restaurant appliances, they are readily accessible for use by the food service industry

[0021] Similarly, the database contains maintenance instructions for each type of kitchen or restaurant appliance If the service personnel is unfamiliar with the appliance, a request may be initialized for the control center to download the necessary repair and maintenance instructions for the appliance under service

[0022] Importantly, the control center includes a database containing customer information, accounting history, appliance data, such as previous repairs and faults, updated diagnostic software and billing data Advantageously, this allows service personnel as well as control center operators to update credits, warranties, or returns for a particular subscriber in real time Also, service personnel may request the control center to generate and transmit various accounting, billing or repair records for a specific subscriber or appliance Such capabilities enhance quality control as well as minimize the amount of work performed by service personnel on administrative tasks

[0023] The control center may, if desired, control in real-time the normal operation for some or all of the kitchen or restaurant appliances For example, to effect a change in a recipe for a particular food product, new cooking parameters may be communicated to the controllers of each desired kitchen or restaurant appliance In this manner, retail food service chains may readily update the cooking profiles of their food products on a global basis

[0024] In another aspect of the invention, the control center may control when the kitchen or restaurant appliances are turned on and off. In this manner, a minimum peak power can be achieved by limiting the number of appliances turned on at any instance in time Moreover, the appliances can be prioritized so that desired appliances can be serviced first, depending on the type of appliance and its relative importance to the location

[0025] Appliance Status/Monitoring

[0026] In accordance with one embodiment, the system may be used to automatically verify the performance of equipment-related manual tasks for equipment used in food preparation The system includes at least one piece of equipment having a microprocessor capable of communicating with the system At least one sensor capable of sensing a parameter related to the performance of at least one equipment-related manual task is provided In one embodiment, the parameter provides an indication of whether the at least one equipment-related manual task was completed In another embodiment, the parameter is indicative of whether the at least one equipment-related manual task was properly performed

[0027] The system further includes a control computer which implements control logic that is operative to automatically monitor the performance of the at least one equipment-related manual task A communication network that is provided allows communication between the computer and one or both of the at least one piece of equipment and sensor The control computer may be resident in a kitchen base station or in a control center The equipment may be a kitchen appliance which in one embodiment may be a fryer

[0028] In one embodiment, the communication network effectuates communications over the Internet In another embodiment, the communication network effectuates communications between the computer and the at least one piece of equipment by wireless data transmission The wireless data transmission may be performed over the Internet

[0029] In another embodiment, the computer generates at least one message pertaining to the at least one equipment-related manual task The at least one message may be displayed on a visual display monitor where, for example, it can be observed by personnel in a food service establishment The message may also be simultaneously delivered by the system to a location remote from the food service

establishment (e g., a control center) via the communication network to inform the food establishment operator or management The message may be accessible to the operator or management over the Internet through a Web interface

[0030] The system may further comprise a database containing stored historical information related to the performance of the at least one equipment-related manual task In one embodiment, the stored historical information comprised information related to one or more of the set of: the type of the at least one equipment-related manual task; when the task was performed; and the identity of the person performing the task

[0031] A method for automatically monitoring the performance of equipment-related manual tasks is also provided which may comprise the steps of:

[0032] providing at least one piece of equipment used in food preparation, said piece of equipment having a microprocessor-based controller;

[0033] providing at least one sensor capable of sensing a parameter related to the performance of at least one equipment-related manual task;

[0034] providing a control computer implementing control logic operative to automatically monitor the performance of the at least one equipment-related manual task;

[0035] providing a communication network allowing communication between the control computer and one or both of the at least one piece of equipment and the sensor;

[0036] monitoring the at least one piece of equipment;

[0037] performing the at least one manual task involving the at least one piece of equipment; and

[0038] sensing the performance of the at least one equipment-related manual task

[0039] In one embodiment, the method further comprises the communication network effectuating communications at least in part over the Internet In another embodiment, the method further comprises effectuating the communication between the control computer and one or both of the at least one piece of equipment and the sensor being at least in part by wireless data transmission The method may further comprise performing the wireless data transmission at least in part over the Internet

[0040] The method may further comprise the step of generating at least one message pertaining to the at least one equipment-related manual task In one embodiment, the method further comprises the step of displaying the at least one message on a visual display monitor

[0041] Shortening Management System

[0042] In accordance with another embodiment, the system may be used to schedule the maintenance for a plurality of kitchen appliances in a food preparation establishment In one embodiment, the appliances may be fryers The system comprises a plurality of kitchen appliances, a computer capable of communicating with the plurality of kitchen appliances, and a communication network linking the computer with the plurality of kitchen appliances The kitchen appliances have microprocessor based controllers that are capable of communicating with the system Control logic is provided which is implemented by the computer and is operative to schedule the maintenance of the plurality of kitchen appliances The control logic may be resident in a kitchen base station or a control center

[0043] In one embodiment, the control logic may be operative to determine the daily consumer demand for at least one cooked food product The system may further comprise the control logic being operative to maximize the number of kitchen appliances available for service at selective time periods during the day, which in one embodiment are peak demand periods for food products The control logic may also be operative to balance the utilization of the plurality of kitchen appliances

[0044] In another embodiment, the system further comprises the maintenance being scheduled so that a maximum number of kitchen appliances available for service at any given time period during the day to coincide with at least one peak demand time period for at least one food product

[0045] In one embodiment, the communication network effectuates communications over the Internet In another embodiment, the communication network effectuates communications between the computer and the at least one piece of equipment by wireless data transmission The wireless data transmission may be performed over the Internet

[0046] A method for scheduling maintenance of a plurality of kitchen appliances in a food preparation establishment is also provided which comprises the steps of:

[0047] providing a plurality of kitchen appliances; providing a computer capable of communicating with the plurality of kitchen appliances;

[0048] providing a communication network linking the computer with the plurality of kitchen appliances;

[0049] providing control logic implemented by the computer;

[0050] monitoring actual operating data of the plurality of kitchen appliances;

[0051] predicting food product demand; and

[0052] scheduling the maintenance of the plurality of kitchen appliances

[0053] In one embodiment, the method involves scheduling maintenance for fryers, which in another embodiment is changing or filtering of cooking medium used in the fryers The method may further comprise scheduling the maintenance of the plurality of kitchen appliances to maximize the number of appliances available at selective time periods during the day In one aspect of the invention, the selective time periods of the method coincide with at least one peak demand time for at least one food product

[0054] Virtual Hold Timer

[0055] In accordance with one embodiment, a system for tracking the hold time of cooked food products is provided comprising: at least one cooked food product having a predetermined hold time; a plurality of food holding areas to hold the at least one cooked food product; a control computer; and control logic implemented by the computer The

control logic is operative to determine when the hold time for the at least one cooked food product elapses

[0056] In one embodiment of the invention, the control logic is also operative to determine if the at least one cooked food product has been moved from a first food holding area to a second food holding area. The control logic may further be operative to record the movement of the at least one cooked food product to the at least second food holding area.

[0057] The control logic may also be operative to generate an expiration signal when the hold time for the at least one cooked food product has elapsed. An audiovisual indicator which, responsive to the expiration signal, may also be provided which indicates that the hold time has elapsed. An audiovisual indicator as used herein is defined to mean either an audio warning or a visual message display.

[0058] In accordance with one embodiment, the control logic of the system may be operative to assign a batch identification number to at least one cooked product. The system may further comprise data entry means to permitting a batch identification number to be manually input into the system to identify in which food holding area the food has been placed. In one embodiment, the batch identification number is input in the system at least in part by wireless data transmission. The data entry means may be a keypad associated with a food holding area.

[0059] The system may further comprise a sensor to measure some parameter related to at least one cooked food product, the sensor providing, to the control computer, a signal relating to the parameter. In one embodiment, the parameter relates to the presence or absence of the at least one food product in a specific holding area. In another embodiment, the parameter relates to the temperature of the at least one cooked food product.

[0060] In accordance with another embodiment, the system may be used to manage the inventory of cooked food products in a food preparation establishment. This system comprises: at least one cooked food product having a predetermined hold time; a plurality of food holding areas to hold the at least one cooked food product; a control computer; and control logic implemented by the computer. The control logic is operative to determine when the hold time for the at least one food product will elapse in the future and to provide advance notification of when the hold time will elapse. The system may further comprise advance notification times corresponding to different types of the at least one cooked food product being stored in a database accessible to the control logic.

[0061] The control logic may also be configured to generate an advance notification message signal indicative of when the hold time will elapse in the future. In response to this signal in one embodiment, an audiovisual indicator provides an advance indication of when the hold time will elapse in the future. The system may further comprise an audiovisual indicator to provide an indication to cook more of the at least one food product before the hold time elapses for the food product. In one embodiment, the system may further comprise the control logic being operative to determine if more of the at least one cooked food product whose hold time will elapse in the future is available or being cooked in another location in the food preparation establishment.

[0062] A method for tracking the hold time of cooked food products is also provided comprising the steps of:

[0063] providing at least one cooked food product having a predetermined hold time;

[0064] providing a plurality of food holding areas for holding the at least one cooked food product;

[0065] providing a control computer;

[0066] providing control logic implemented by the computer, the control logic being operative to determine when the hold time for the at least one cooked food product elapses; and

[0067] determining when the hold time for the at least one cooked food product elapses.

[0068] The method may further comprise providing a data entry means to manually input a batch identification number of the at least one cooked food product into the control computer. In one embodiment, the method further includes the step of determining if the at least one cooked food product has been moved from a first food holding area to at least a second food holding area. The method may further include displaying a message that the hold time has expired for the at least one cooked food product. In another embodiment, the method comprises assigning a batch identification number to the at least one cooked food product.

[0069] A method is also provided for managing the inventory of cooked food products in a food preparation establishment comprising the steps of:

[0070] providing at least one cooked food product having a predetermined hold time;

[0071] providing a plurality of food holding areas for holding the at least one cooked food product;

[0072] providing a control computer;

[0073] providing control logic implemented by the control computer, the control logic being operative to determine when the hold time for the at least one food product will elapse in the future and to provide advance notification of when the hold time will elapse.

[0074] determining when the hold time for the at least one food product will elapse in the future; and

[0075] providing advance notification of when the hold time for the at least one food product will elapse in the future.

[0076] In one embodiment, the method may further comprise notifying food preparation establishment personnel to cook more of the at least one cooked food product before the hold time elapses for the at least one cooked food product. The method may also comprise determining if more of the at least one cooked food product whose hold time will elapse in the future is available or being cooked in another location in the food preparation establishment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0077] The features and advantages of the present invention will become more readily apparent from the following detailed description of the invention in which like elements are labeled similarly and in which:

[0078] **FIG. 1** is a pictorial representation of the present smart commercial kitchen network including a control center, a plurality of kitchen base stations, and a plurality of kitchen or restaurant appliances;

[0079] **FIG. 2** is a more detailed block diagram of the appliances and the kitchen base stations of **FIG. 1**;

[0080] **FIG. 3** is a more detailed block diagram of the control center of **FIG. 1**;

[0081] **FIG. 4** is an exemplary illustration of a coverage map as it might be displayed to a control center operator;

[0082] **FIG. 5** is a block diagram of the transmitter and receiver of a kitchen or restaurant appliance used in accordance with the present invention;

[0083] **FIG. 6** is a flow chart illustrating the operation of the kitchen base station of **FIG. 1**;

[0084] **FIGS. 7A and 7B** are flow charts illustrating the operation of the control center of **FIG. 1**;

[0085] **FIG. 8** is a pictorial representation of the repair process used in accordance with the present invention;

[0086] **FIG. 9A** is a schematic diagram representing a flyer and food hold arrangement for a commercial kitchen including a plurality of fryers and food holding areas;

[0087] **FIG. 9B** is a schematic diagram representing a deep vat fryer and various appurtenances;

[0088] **FIG. 9C** is a flow chart showing exemplary control logic of the system for automatically verifying the completion of cooking appliance related tasks that are performed manually;

[0089] **FIG. 10A** is a flow chart showing exemplary control logic of the system for a virtual hold timer used to track the movement of batches of food through a commercial kitchen and determining when the food hold time has expired;

[0090] **FIG. 10B** is a flow chart showing exemplary control logic of the system for assisting commercial kitchen management with inventory control of cooked food products; and

[0091] **FIG. 11** is a flow chart showing exemplary control logic of the system for providing networked cooking medium maintenance for a plurality of flyers

DETAILED DESCRIPTION

[0092] The inventive Smart Commercial Kitchen (SCK) network has the ability, among other things, in real-time to monitor and control the maintenance, repair and energy management of kitchen or restaurant appliances located over a wide geographical area Maintenance and repair, once initialized, are monitored through a control center which contains the necessary software diagnostics, accounting records, inventory records, and maintenance records for the particular appliance under service The capability to integrate these various accounting and repair services affords a highly efficient means for providing timely service to system subscribers The SCK network may be customized to the particular needs of the subscribers, and due to the preferred use of wireless communication, such as cellular radio communication, may be installed and used virtually anywhere in the world

[0093] It is contemplated that the present SCK network may be realized, in part, by wireless communication It is to be understood, however, that the network described below is for the purpose of illustration only and not for the purpose of limitation Other suitable communication, whether optical or wired, may be used with the present invention

[0094] Also, in the embodiment below, integrated repair and accounting services are provided and coordinated preferably through a centralized control center It should, however, be clearly understood that some of these services may be distributed or off loaded to base stations which may be programmed to effect these latter services The choice is dependent on whether the network is structured as a highly centralized or distributed architecture

[0095] Referring to **FIG. 1**, there is shown—in schematic block diagram—a communication system **100** in accordance with the principles of the invention In **FIG. 1**, an arbitrary geographic area may be divided into a plurality of radio coverage areas or cells **105** (C_1-C_6). It should be clearly understood that these cells may be located within the same or different buildings. While the system in **FIG. 1** is shown to include only six (6) cells, it should be clearly understood that the number of cells may be much larger

[0096] Associated with and located within each of cells **105** (C_1-C_6)is one or more kitchen or restaurant appliances **110** (A_1-A_{11}) under subscription to the services of the system Each kitchen appliance **110** (A_1-A_{11}) is preferably provided with a RF transmitter **120**, RF receiver **130** and microprocessor based controller **140**, as illustrated in **FIG. 2**. Alternatively, each kitchen appliance may effect communications through wire data links Restaurants, bakeries or hotels, for example, can have anywhere from one to forty (40) kitchen appliances at a single site or cell Such kitchen or restaurant appliances include, for example, deep fryers, refractory ovens, baking ovens, combination ovens, infrared ovens, rotisseries, refrigerators, I-WAC systems, and the like

[0097] Microprocessor based controllers have been developed, for example, by Food Automation—Service Techniques, Inc (FAST)® of Connecticut in recent years to assist in the preparation of properly cooked foods These controllers, sold under the trade name FASTRON®, among other things, regulate the temperature within the kitchen appliance to insure that the food is cooked or baked to the proper degree of doneness More particularly, under program control, the controller regulates the various operations of the kitchen appliance, such as the cooking time and temperature, for either a single food product or a plurality of food products That is, the kitchen appliance is programmed to operate with cooking parameters tailored for a specific food product See, for example, U S Pat No 4,920,948, which is incorporated herein by reference

[0098] Moreover, the controller regulates the percentage of time power is applied to the heating (or cooling) element in accordance with the cooking parameters selected by the user For example, the heating element or heating elements may be pulsed with either a fixed or variable duty cycle (proportional control heating), may be fully turned on, or

operated in an off/on manner similar to a thermostat, depending on the heating mode of the kitchen appliance

[0099] Moreover, such controllers may include built-in intelligent sensing and diagnostic equipment, which coupled through an interface board, detect and identify various types of failures Such failures include faulty heaters, sensors, fans, and the like See, for example, U S Pat No. 5,043,860 and applicants' copending applications: U S Ser No 08/501,211 and U S application entitled "Diagnostic System For A Cooking Appliance" filed Oct 26, 1995, Ser No 08/549,098, which all are commonly assigned and incorporated herein by reference

[0100] With continuing reference to **FIG. 1**, kitchen base stations **150** (B_1-B_6) may be found within respective cells **105** (C_1-C_6) Preferably, each kitchen base station **150** (B_1-B_6) is capable of communicating through wireless means, such as through cellular radio or other wireless means, with corresponding kitchen appliances **110** (A_1-A_{11}) If desired, manual changes in the menus or the cooking profiles may be made through an appropriate terminal **155** attached to the base station As such, each kitchen base station **150** (B_1-B_6) includes a RF transmitter **160** and RF receiver **165**, as illustrated in **FIG. 2** Wire interconnections are not desirable, due primarily to the likelihood of such wires being inadvertently cut by culinary instruments It should, however, be understood that wire interconnections may be used Of course, satellite, microwave or infrared communication may also be used in accordance with principles known to those skilled in the art

[0101] Preferably, each of cells **105** (C_1-C_6) is allocated at least one cellular radio channel used to effect bidirectional communication so as to monitor and track the maintenance, repair and energy management of kitchen appliances **110** (A_1-A_{11}) by means of information transmitted to and received from those appliances Such information may include cooking parameters, billing information, appliance identification, diagnostic information, and maintenance instructions, as discussed herein below Those skilled in the art will readily note that the channels may operate either in an analog or a digital mode or a combination thereof In the digital mode, analog signals are converted to digital representations prior to transmission over the RF channel Purely data messages, such as those generated by microprocessor based controller **140** may be formatted and transmitted directly over a digital channel

[0102] Communication is provided between kitchen base stations **150** (B_1-B_6)and a control center **170** through communication links **175** of a data network **180** Control center **170** may be attended by one or more trained operators through terminals **185** Digital links operating at 56 Kb/sec or higher may be used as communication links **175** The data network **180** may be an integrated system digital network (ISDN) facility In this latter instance, the X 25 protocol, may be used for facilitating the sending of message data between kitchen base stations **150** (B_1-B_6)and control center **170** The X 25 protocol is well known to those of ordinary skill in the art and will not be discussed herein for the sake of clarity

[0103] It should be understood that control center **170** includes a repair and accounting database **190** that permits the exchange of information relating to repair, accounting and billing In addition, each kitchen base station **150** may contain internally resident databases necessary or useful in the customer billing or accounting process Control center **170** may be, for example, located within the same physical location as the cells For extended coverage around the world, however, a plurality of control centers linked to each other may be employed

[0104] Each kitchen base station **150** (B_1-B_6) may interrogate a corresponding controller **140** or controller **140** may request to transmit diagnostic information relating to the operating conditions of kitchen appliances **110** (A_1-A_{11}), which diagnostic information may be immediately communicated to control center **170** It is contemplated that this diagnostic information may also be stored in internally resident databases of the kitchen base stations Control center **170** may take action as appropriate, including, among other things, downloading updated diagnostic software to controller **140**, dispatching a service vehicle **195** through a mobile kitchen center **200**, or updating accounting and inventory information, which is discussed in more detail herein below Most of the functions are automatically controlled by control center **170**, but may be also performed manually by the control center operator If desired, some of these functions may be distributed to the base stations

[0105] Service vehicle **195** is provided, maintained and operated independently by the service agency subscribers to the system Although **FIG. 1** only shows one service vehicle, it should be clearly understood that in practice a fleet of service vehicles would be used

[0106] Communication network **100** also is preferably linked to a generic point of sale (POS) or an automated teller machine (ATM) system **205** which is linked to each of kitchen base stations **150** through data communication network **180** Further ATM/POS system **205** includes a POS/ATM data communication network **210**. Plurality of independently operated ATM/POS systems all intercommunicate simultaneously in order to provide billing service to subscribers of the inventive communication network A clearing house data communication network also interconnects the plurality of ATM/POS systems to clearing house network centers By transferring information among the different ATM/POS systems operated by various merchants, the clearing housing data communication network and the clearing house network centers allow direct inter-institution transactions, such as between ATM/POS system **205** and the particular ATM/POS system operated by the subscriber's financial institution

[0107] Referring to the illustration of **FIG. 3**, control center **170** may include a communication controller **215**, and a display controller **220**, there being a suitable conventional interface **225** therebetween As stated above, control center **170** includes database **190** containing, for example, the locations of the kitchen appliances, diagnostic software, associated accounting and billing information, and energy management data, as discussed herein below Interface **225** may be a local area network (LAN) interface, having one or more terminals **185**, allowing control center operators to enter information Terminals **185** are understood to include any of a variety of input devices such as a keyboard, mouse, trackball, or other user interface

[0108] Communication controller **215**, among other things, serves as a processor and buffer between kitchen base stations **150**, and display controller **220** and database **190**

Data transmitted through communication controller **215** may be displayed on a communication display **230**. Display controller **220** is provided with a map display which displays information regarding the kitchen appliances in a graphical manner, such as on pre-existing digitized maps of arbitrarily large geographical areas, such as a city or state. Such a coverage display is illustrated in **FIG. 4**. For example, appliances may be noted by dots, with those requiring service indicated in red. Other suitable legends may be displayed, for example, indicating the type of appliance, last service day, parts availability, among other things.

[0109] Referring next to **FIG. 5**, there is shown therein a simplified schematic block diagram of the equipment for kitchen appliances **105** used to transmit and receive data from kitchen base stations **150** in accordance with the present invention. In particular, the equipment illustrated in **FIG. 5**, may be used for communication to kitchen base stations **150** over digital channels. Data destined for transmission to the kitchen base station is divided into data packets of messages in accordance, for example, with the time division multiple access (TDMA) technique of digital communications. Those skilled in the are will readily note that other techniques may be used, such as CDMA. Data packets along with supervisory messages generated by a so-called fast associated control channel (FACCH) generator **515** are time division multiplexed by multiplexer **510**. The output of multiplexer **510** is provided as an input to a burst interleaver **520** that divides the data into n consecutive time slots, each occupied by a byte consisting of m bits of control information. This interleaved data forms the input to a burst generator **525** that produces "messages burst" of data, each consisting of a time slot identifier, digital verification code, control or supervisory information and the data to be transmitted.

[0110] The message burst produced by burst generator **525** is provided as an input to a RF modulator **530**. RF modulator **530** is used for modulating a carrier frequency according to, for example, the $\pi/4$ DQPSK technique that is well known those in the art of cellular radio communication. The use of this technique implies that the information transmitted by each appliance transmitter is differentially encoded, that is two bit symbols are transmitted as four possible changes in phase: + or $-\pi/4$ and + or $-3\pi/4$. The carrier frequency for the selected transmitted channel is supplied to the RF modulator by a transmitting frequency synthesizer **535**. The burst modulated carrier signal output of RF modulator **530** is amplified by a power amplifier **540** and then transmitted to the base station through an antenna **545**.

[0111] Each appliance **110** receives burst modulated signals from kitchen base stations **150** through an antenna **550** connected to a receiver **555**. A receiver carrier frequency for the selected receiving channel is generated by a receiving frequency synthesizer **560** and supplied to a RF demodulator **565**. RF demodulator **565** is used to demodulate the received carrier signal into an intermediate frequency (IF) signal. The intermediate frequency signal is then demodulated further by an IF demodulator **570** which recovers the original digital information as it existed prior to $\pi/4$ DQPSK modulation. The digital information is then passed to symbol detector **575** which converts the two bit symbol format of the digital data provided to a single bit data stream. For a more detailed description on the use of cellular radio communication, see, for example, Cellular Radio: Principles and Design, Raymond C. V. Macario, McGraw-Hill, Inc. 1993.

[0112] Those skilled in the art will readily note that much of the equipment used by appliances **110** to effect cellular communication may also be used by kitchen base stations **150** and mobile kitchen center **200**. Accordingly, for the sake of simplicity, that equipment will not be discussed herein. There is, however, one important difference. Kitchen base stations **150**, unlike appliances **110**, are preferably connected to control center **170** through high speed communication links of data network **180**. Also, kitchen base stations **150** each includes a microprocessor **167** that controls the activities of the base station and communication among the appliances and the kitchen base stations. Decisions are made by the microprocessor in accordance with data received from control center **170**. The microprocessor is also provided with terminal keyboard and display unit **155** that allows a user to exchange information with appliances **110** as well as with control center **170**.

[0113] **FIG. 6** is a simplified flow chart illustrating the operation of the kitchen base station. Briefly, the flow chart includes a sequence of generally repetitive instructions arranged in a loop in which the station polls or is interrupted by special events and branches to an appropriate communication mode.

[0114] On power up at block **600**, control passes to block **605** which determines whether data has been received from the kitchen appliances. Essentially decision block **605** determines whether the kitchen appliance (s) are communicating to the control center. If such communication is requested, control passes to block **610** to effect communication. Otherwise, block **615** determines whether the control center is attempting to communicate with the kitchen appliance(s). If so, at block **620** the received data is forwarded to the appropriate appliance. Control then passes to block **625** which determines if an operator has entered any message data, either to an appliance or the control center. Any such data is then transmitted at block **630**.

[0115] In general; an application-oriented protocol is used to coordinate the activities between the appliances and the control center to ensure common syntax semantics for the transmitted application data. For example, the application-oriental protocol may specify a particular type of encoding for appliance identification data as well as the origination of such information with a message. The application-oriented protocol formats the messages and transmits either to the kitchen appliance or the control center. Control center **170** may transmit, for example, updated diagnostic software for the appliance, updated cooking profiles, and in general, data associated with the operations of the kitchen appliances. On the other hand, data transmitted from the kitchen appliance may include identified failures or malfunctions in the cooking appliance, including kitchen appliance identification information.

[0116] Normally, monitoring and tracking control passes to the control center after a malfunction or fault has been reported by the microprocessor based controller. However, the control center may effect preventive maintenance even when there is no malfunction reported. Scheduled preventive maintenances are stored in database **190**. Alternatively, each base station may request preventive maintenance for its associated kitchen appliance(s). At the appropriate time, control center **170** dispatches a service vehicle.

[0117] Referring now to **FIGS. 7A and 7B**, the operation of the control center is illustrated. **FIGS. 7A and 7B** show the manner in which the control center in the present embodiment tracks and monitors repair and maintenance. In most instances, it is understood that the control center initializes service only to effect repair or preventive maintenance. Integrated with this function is the system's capability to effect billing and accounting.

[0118] Normally, message data from the appliances consists of four different types: repair, billing, diagnostic or reports. At decision blocks **705**, **710**, **715** and **720**, control center **170** determines which type of message data it is. Block **705** checks for repair message data. If, in decision block **725**, a repair request has been received from the appliance, control then passes to block **755** which, once identifying the location of the appliance and the nearest service agency, dispatches a service vehicle.

[0119] Those skilled in the art will readily note that the network system of the present invention allows the control center to monitor kitchen appliances located over wide geographical areas for early warning of failure or degradation in performance. If the degradation, however, is gross, the control center may communicate and display on the console of the kitchen appliance a message warning that the kitchen appliance is unacceptable for cooking purposes. If desired, the control center may be programmed in the latter instance to disable the kitchen appliance to eliminate any possible health risks. Alternatively, the cooking parameters of the kitchen appliance may be changed to compensate for the malfunctioning appliance until repairs can be effected.

[0120] Once a service vehicle has been dispatched, any graphical display of the appliances as well as database **190** is updated to indicate the current status of the appliance under service, as noted at block **760**.

[0121] It is contemplated that the control center responds to diagnostics information transmitted periodically by the appliance. At block **730**, such diagnostic information is stored in database **190**. This diagnostic information may include, but is not limited to the information indicated below:

- Appliance Location
- Appliance Type
- Controller Type
- Diagnostic Software Version
- Last Repair Date
- Next Maintenance Date
- Time Stamp
- Date Stamp
- Type of Malfunction
  - Heaters
  - Fans
  - Power supplies
  - Sensors
  - Electronics
  - Software
- Statistical Cooking Data
  - Hours of Operation
  - Deviations From Operating Temperature
  - Deviations From Normal Operating Temperature
- Gradients
  - Cooking Profiles
    - Time
    - Temperature

-continued

- Fan setting
- Humidity setting
- Rotation Setting (for rotisserie)
- Belt Speed
- Damper Position
- Microwave Energy Setting
- Refrigeration Time and Temperature

[0122] According to the preferred embodiment, control center **170** analyzes at block **735** such diagnostic information so as to determine whether to disable the appliance at block **740** or at block **745** to modify the cooking profiles stored in the appliance. Such analysis may use the techniques disclosed, for example, in U.S. Pat. No. 5,043,860, U.S. Ser. No. 08/501,211 and U.S. Patent application entitled "Diagnostic System For A Cooking Appliance," (Ser. No. 08/549,098), filed Oct. 26, 1995. The generation of other such diagnostic-specific software may be realized by those programmers of ordinary skill in the art of cooking. For example, it is contemplated that such diagnostic software may use artificial intelligence or so-called "fuzzy-logic." Such diagnostic information stored in database **190** may also be later retrieved and used for quality control to determine the frequency and type of failures for specific types of kitchen appliances.

[0123] By way of reiteration, based on information transmitted to control center **170**, a repair person may be dispatched to the site of the kitchen appliance requiring service or preventive maintenance. This dispatch can be effected through radio communication (e.g., mobile kitchen station **200**) or through the use of an ordinary telephone to the appropriate service center nearest to the location of the kitchen appliance.

[0124] Referring to **FIG. 8**, on site repair is enhanced through the use of a portable hand held terminal **810** having, for example, a Palm/Laptop computer linked to microprocessor based controller **140** by a suitable interface, such as, for example, a wireless RS-232 interface using infrared communication. Of course, wireline or optical interfaces may also be used. Such hand held pocket computers are readily available from Texas Instruments, Hewlett Packard and Casio, among others. Hand held terminal **810** interrogates the controller so as to ascertain the model and model number of the appliance under service, and then diagnoses abnormal operating conditions. Of course, should infrared communication be used, controller **140** is equipped with an infrared transmitter/receiver **820**. The low-level software is readily capable of implementation by those skilled in the art. For example, conventional database management software may be employed in the hand held terminal along with suitable diagnostic software. It is contemplated that such software and the like, for example, may be stored in standardized memory cards conforming to both the JEIDA and PCMIA standards. Both standards are substantially identical for use in 68 pin interchangeable memory cards.

[0125] Hand held terminal **810** also has a local RF receiver and transceiver provided with an antenna by which it communicates to control center **170** via kitchen base station **150**. Cellular communication to the kitchen base station may

be effected as discussed above herein To preserve the data contents of the hand held terminal, a memory back-up battery is preferable

[0126] Prior to effecting repairs, terminal **810**, however, may request from control center **170** the associated accounting and service information associated with the appliance under service. This is illustrated in block **710** of **FIG. 7A** Such accounting and service information includes, but is not limited to:

[0127] Customer Name

[0128] Customer Location

[0129] ID

[0130] Service Area

[0131] Account Number

[0132] Bank

[0133] Service Warranties

[0134] Credits

[0135] Upon effecting repair, control center **170** prepares and transmits at block **770** an appropriate invoice The subscriber or an authorized person thereof then enters a security password or code, such as a personal identification number (PIN) authorizing funds to be transferred from the subscriber's institution to the service agency that performed the repair or maintenance Alternatively, an unauthorized signature may be digitalized and captured Upon approval, control center **170** at block **775** initiates a transfer of funds from the customer's or subscriber's financial institution to the account of the service agency Once completed, the invoice is transmitted at block **780** to terminal **810** which then prints a hard copy of the invoice

[0136] Those skilled in the art will readily recognize the advantages of this integrated billing and accounting services inasmuch as this eliminates the need for any accounting back at the office of the service agency

[0137] Alternatively, inasmuch as hand held terminal **810** contains the billing records for the appliance under service, the invoice may be prepared by hand held terminal **810** In this latter case, hand held terminal **810** is embedded in memory with the standard billing and invoicing format Once prepared, the billing records may be transmitted to control center **170** In this manner, some of the accounting functions may be distributed or off loaded to the hand held terminals Of course, those skilled in the art will readily realize that kitchen base stations **150** may also be programmed to prepare the invoice These latter choices are dependent on whether the network is structured as a highly centralized or distributed architecture

[0138] Once repairs have been made, control center **170** then updates the accounting, billing and maintenance records within the database Also, control center **170** may update inventory, taking into account any parts used in making the repairs In this manner, service personnel may later readily ascertain the availability of parts for a particular appliance, such as through hand held terminal **810**

[0139] During repairs, should terminal **810** require updated diagnostic software for the particular appliance under service, such a request is transmitted to the control center Such a request is responded to at block **715**, with the appropriate software then transmitted to terminal **810** via the communication network, as indicated at block **785** In this manner, as new diagnostic tools become available for specific kitchen appliances, they are now readily accessible for use by the food service industry

[0140] Similarly, database **190** may contain maintenance instructions for each type of kitchen appliance If the service personnel is unfamiliar with the appliance, a request may be initialized for control center **170** to download the necessary repair and maintenance instructions for the appliance under service

[0141] Importantly, control center **170** includes database **190** containing customer information, accounting history, appliance data, such as previous repairs and faults, updated diagnostic software and billing data Advantageously, this allows service personnel as well as control center operators to update credits, warranties, or returns for a particular subscriber in real time Also, service personnel may request at block **720** for center **170** to generate and transmit various records for a specific subscriber or appliance as indicated below;

[0142] Payment History

[0143] Maintenance History

[0144] Appliance Part Inventory

[0145] Customer Data

[0146] Prior Repairs or Malfunctions

[0147] Warranty Records

[0148] Such capabilities enhance quality control as well as minimize the amount of work performed by service personnel on administrative tasks Database management software running under UNIX may be employed in control center **170**, which is readily capable of implementation by those skilled in the art

[0149] Also, it is contemplated that the control center may, if desired, control in real-time the normal operation for some or all of the kitchen appliances For example, to effect a change in a recipe for a particular food product, new cooking parameters may be communicated to the controllers of each desired kitchen appliance. In this manner, retail food service chains, such as McDonald's® or Burger King®, may readily update the cooking profiles of their food products on a global basis

[0150] Those skilled in the art will readily understand that during normal operation, the controller of each kitchen appliance regulates the percentage of time power is applied to the heating means in accordance with the stored cooking profiles of the food products For example, the heating means may be pulsed with either a fixed or variable duty cycle, may be fully turned on, or operated in an on/off manner similar to a thermostat The specific control algorithm is based on the particular type of kitchen appliance being controlled, for example, fryer, oven, air conditioner or the like

[0151] In accordance with principles of the invention, it is further contemplated that the control center may, if desired, alternatively control in real time the peak power demand of the kitchen appliances, for example, in accordance with the

relative priorities thereof Of course, each base station may control the peak power demand, if desired That is, the control center controls the amount of power utilized by the kitchen appliances within each cell or cells by controlling when various heating (or cooling) means of the kitchen appliances are turned "on" This is especially important inasmuch as one of the key parameters in determining electrical rates charged by a utility company is determined by the peak power load within a specific period of time Normally, the utility company charges a customer a higher rate to deliver a higher peak power

[0152] Advantageously, a minimum peak power can be achieved by limiting the number of kitchen appliances that are turned on at any one time Moreover, the kitchen appliances can be prioritized so that desired appliances can be serviced first with respect to energy management, depending on the nature of the appliance and its relative priority or importance to the user

[0153] Included in the diagnostic information periodically transmitted to control center **170** may be the actual power demand of the kitchen appliances During normal operation, control center **170** determines the limit for the maximum power demand within each cell or desired number of cells Preferably, the maximum power demand for each cell is user programmable and is stored, for example, in database **190**. The actual power demand is dependent on the type and number of the kitchen appliances in each cell or cells If the actual power demand exceeds the maximum power demand limit, control center **170** may reduce the duty cycle of at least one of the kitchen appliance as discussed in more detail herein below That is, the "OFF" period of the duty cycle of one or more appliances is lengthen It should be understood that the duty cycle herein refers to the amount of time the electrical load, e g , the heating or cooling element, within the kitchen appliance is powered "ON" and "OFF"

[0154] In other words, the system determines whether the maximum demand will be exceeded by comparing the calculated load to the maximum system load value The maximum system load value is user programmable The calculated load is determined by factoring the power requirements of the appliances currently operating within the cell or cells It is contemplated that the user has the capability to change the system configuration, by entering the power requirements of each appliance, the priority of the appliance and other parameters such as the control algorithm used in regulating the temperature

[0155] Preferably, each kitchen appliance is preprogrammed with a minimum power On/Off duty cycle to ensure that the appliances operate acceptably For example, during idle, the duty cycle may be varied greatly Also, for those appliances having mechanical relays which deteriorate when exercised frequently, it is desirable to limit the frequency that the relays are closed or opened This is achieved by preprogramming and following minimum On/Off times For example, the minimum "ON" time might be 4 seconds and the minimum "OFF" time might be 2 seconds

[0156] When control center **170** determines that the maximum demand in a cell or desired number of cells will be exceeded, selected kitchen appliances with the lowest priority and powered "on" for the minimum time are placed into a power cycle "off' state by control center **170** Inasmuch as controller **140** and thus control center **170** knows whether the appliance is in an idle or cook mode, the appliance can judiciously be turned off without affecting the operation of the appliance Alternatively, base station **105** may place the appropriate kitchen appliance in the power cycle "off' state and inform control center **170** of its actions Additionally, other kitchen appliances, which may not be currently operating, may have their "off time extended by control center **170**, which is effected through communication to and from the corresponding microprocessor controller **140** For example, when the maximum demand level is exceeded, lowest priority appliances on for the minimum "ON" time are turned "OFF" Then, low priority appliances will have their "OFF' times lengthen by, for example, one second After an evaluation delay time, power demand of appliances within the cell or cells are evaluated again and appropriate action taken, including, if necessary, shortening the "OFF" times on a priority basis

[0157] In the above manner, control center **170** preforms a so-called "load leveling" algorithm to bring the power demand level within each cell or cells within a "safety" band". Such a "loading leveling" algorithm may be required when additional kitchen appliances within each cell or cells wish to go online

[0158] It should be understood that the above safety band is a range below the maximum allowed demand which allows the kitchen appliances to operate in a cycled manner, e g , variable duty cycle or pulsed When the power demand is below the safety band there is power capability to handle more appliances for operation When the demand is within the safety band, the appliances within the corresponding cell are said to operating harmoniously When the power demand is below the safety band the control center adjusts the allowable "OFF" times of the kitchen appliances by shortening the "Off' time of prioritized appliances

[0159] The maximum safety band is programmable and may, for example, be set to 5% of the maximum demand The result is that all appliances under control within a cell will be controlled without interruption up to the maximum demand level When the maximum demand level is exceeded, the power cycling of the lowest priority operating kitchen appliance is modified by reducing the duty cycle The portion of the maximum cell load allocated to each appliance is programmed into the control center Allocation of the maximum cell load is performed by determining the total maximum cell load requirement and the desired maximum cell load Such information may then be used to calculate the percentage of load each appliances contributes to the total power load For example, a appliance rated at 2 Kw within a cell with 40 Kw of appliances contributes to 5% of the load With a desired maximum system load of 20 Kw, the appliance uses 1 Kw of the maximum load

[0160] Preferably, the present network accumulates the on/off state of each kitchen appliance at one second intervals or less for a 15 minute time period This latter data is used to determine the current peak power demand. Those skilled in the art will readily recognize that the appliance priorities vary as to the time of day For example, fryers would have a lower priority in the breakfast menu time than a lunchtime when they are heavily used Accordingly, it is contemplated that the appliance priority may be user programmed to vary with expected demand

[0161] Another uniqueness of the present SCK network is that company assets may be readily audited without the need

of sending auditors into the field. Indeed, the control center would not only have a database of the locations of the appliances, but what their statistical failure rates were, which service agency had the parts and inventory for a specific appliance, among other things. Compared with the prior art philosophy of reacting to malfunctions, the present system actively monitors the performance of the appliance, providing not only a quality control function, but minimizing in the long, run repair cost.

[0162] It should be emphasized that the above described flow charts are merely examples of the how the system may be programmed in order to effect the tracking and monitoring of activities directed to billing, repair and maintenance. Other application-specific software may readily be realized by those skilled in the art and who have been equipped with the understanding of the operation of the present invention as set forth in the above description.

[0163] Accordingly, it should be understood that the embodiment herein is merely illustrative of the principles of the invention. Various modifications may be made by those skilled in the art which will embody the principles of the invention and fall within the spirit and the scope thereof. For example, hardwired, fiber, infrared or microwave communication channels may be used to link the kitchen or cooking appliances to the control center. Furthermore, the some of the repair and accounting services may be distributed or off loaded to the base stations.

[0164] Appliance Status/Monitoring

[0165] Referring now to **FIGS. 9A, 9B**, and 9C, the system of the present invention may be used to automatically determine whether and when various kitchen appliance-related cooking or maintenance tasks have been completed and/or properly performed by an employee. The system can accomplish this by detecting or sensing various operating parameters associated with a particular appliance. This eliminates the need to rely on the employee to manually activate a "bump bar" (typically associated with a CRT display) to notify the system that a cooking or maintenance task has been completed. The determination of task completion based on sensed parameters rather than by an indication by an employee reduces the possibility that an employee will take shortcuts or cheat in performing a required task and reporting its completion to the system via the bump bar. In fact, the present invention eliminates the need for a bump bar as a means for the employee to communicate with the system.

[0166] In one embodiment, for example, the system may be used to verify the proper cooking of a food product prepared by batch cooking in a deep vat fryer. Referring to **FIG. 9A**, a typical restaurant or other food preparation establishment kitchen **900** may contain several deep vat fryers **901** (F_1-F_3) having microprocessor based controllers, several food holding areas **902** (FHB_1-FHB_3) located in the back of the kitchen in a staging area, for example, and several food holding areas **915** ($FHPOS_1$-$FHPOS_3$) located at the point of sale (POS) for delivery to the consumer. Food holding areas are well known in the art and are used to hold or keep food after it has been cooked until it is ultimately sold to the consumer. Although food holding areas may be unheated, they often may have a heat source to keep the cooked food at a selected temperature to extend the shelf life of the cooked food product before it must be discarded when its holding time expires. Such heat sources may include, but are not limited to infrared radiation, heat bulbs, electric heaters, steam heat, gas heat, hot air blowers, etc. Alphanumeric data entry keypads **916** may also be provided with the food holding areas **902** and **915** whose purpose will become apparent in the discussion below on **FIG. 10A**. Once food is finished cooking in any of the fryers **901**, it may placed and held in any of the food holding bins **902**, or alternatively may be placed directly and held in any of the food holding bins **915** at the POS if consumer demand is immediate. The restaurant management and employees may decide into which holding bins **902** or **915** the food is placed, or alternatively, the selection may be dictated automatically by the system as described below with the discussion on **FIG. 10A**.

[0167] Referring now to **FIG. 9B**, the physical cooking hardware associated with each deep vat fryer **901** may consist of a deep vat **903** into which is inserted a cooking basket **904** that holds the food product **905** while it is cooking. A placement sensor **906** is located inside vat **903** which provides verification that cooking basket **904** has been inserted (placed) into or removed from the fryer. The placement sensor **906** may be a toggle-type electrical switch, proximity sensor, or any other type switch or sensor as will be readily known to those skilled in the art that is capable of providing a means for detecting that the cooking basket has been inserted into or removed from the fryer. Cooking medium **907**, typically oil or shortening, is provided along with at least one heating element **908** which increases and maintains the temperature of the medium T_{medium} at the proper cooking temperature T_{cook}. A temperature sensor **909** is also provided with the deep vat **903** to measure the temperature T_{medium} of the cooking medium **907**. A CRT monitor **910** is provided to serve at least one fryer **901** and is used to display information communicated to the food preparer(s) from the system of the present invention. However, a single CRT monitor **910** may provide service to more than one fryer **901** and/or food holding bin **902**.

[0168] Exemplary control logic that may be used with the system of the present invention for controlling the proper cooking of food product **906** in the deep fryer **901** described above is shown in **FIG. 9C**. This control logic may reside and be implemented in a kitchen base station or the control center, at the system user's discretion. The kitchen base station and control center data processors may be, but are not limited to, a conventional stand-alone computer unit or several interconnected and networked units capable of executing the necessary arithmetic and logic operations, and carrying out the required communication and networked functions of the invention. Indeed, any type or combination of microprocessors or processors capable of executing the operations required by the system described herein are suitable for use in the invention and will be readily apparent to those skilled in the art. The computer unit or networked computers may be provided with all necessary peripheral devices (e.g., modems, printers, scanners, CRT displays, etc.) whose selection will be readily apparent to those skilled in the art. The type of peripherals selected is a matter of design choice and dependent upon the specific intended application of the system.

[0169] Logic process **920** begins the cooking and control process in step **930**. In step **940**, the system receives a cooking command signal to start preparing a batch of food

product **906**. The decision to cook another batch of food product **906** may be determined manually by, for example, a food preparer. In this case, the food preparer may simply push a button located on the appliance to initiate sending the cooking command signal to the system, which signal is received in step **940**. Alternatively, the cooking command signal may be input into the system electronically by any number of system input interface methods (e.g., via a keyboard, voice command, wireless device, etc.). The employee may also designate and input the type of food product **906** to be cooked (e.g., fried chicken, fried fish, french fries, etc.) into the system.

[0170] The cooking command signal may also be automatically generated by the system of the present invention based on input received from the POS (point of service) system or other system-based determinations. For example, the POS system may recognize a demand for fried chicken which exceeds the current inventory, based on a comparison of the number of customer orders received with available supplies of fried chicken on hand in the food holding bins **902** and **915**. The system then generates the command signal to cook more fried chicken to ensure an adequate supply is available to meet the anticipated demand.

[0171] Still referring to **FIG. 9C**, the control logic is pre-programmed in step **931** with the proper cooking time T_{cook} for the particular food product **906** to be prepared. Cooking time T_{cook} represents the total cooking time required to properly cook the food as a function of the cooking medium temperature T_{medium}. This information may be electronically stored in a lookup table or database accessible to the system. Where deep vat fryers **901** (F_1-F_3) are used to cook different types of food products **906**, the proper cooking time for each type may be stored in the lookup table or data base, and then be automatically determined by the system from the cooking command signal which identifies the variety of food product to be cooked. The system may be used to assist in determining the cooking time T_{cook} by sensing and reading the temperature of the cooking medium T_{medium} via temperature probe **909** in fryer vat **903**. The system then accesses the lookup table or database into which has been input various cooking times T_{cook} versus cooking medium temperatures T_{medium} for any number of types of food products **906**.

[0172] Responsive to the signal generated in step **940**, the system may provide an audiovisual indicator, which may be either an audio warning or a visual message displayed on a CRT as shown in step **950**, instructing the food preparer to cook food product **906**. The food product may be identified by name in the message (e.g., fried chicken, fried fish, french fries, etc.) which has been programmed into the system and input into the cooking time t_{cook} lookup table or database. This message may be displayed on CRT monitor **910** as shown in **FIG. 9B**. The system next performs a test in step **960** to determine if the placement sensor **906** has been activated, thereby providing an objective, positive indication that the food preparer has inserted the food basket **904** with food product **906** into the fryer vat **903**. If the placement sensor **906** has not been activated, control returns to step **960** to repeat the test. The logic can also be configured to deliver a second, renewed instruction if the desired action contained in the initial message has not occurred and been sensed by the system within a predetermined first response time (which may be programmed into the system) from when the initial message was delivered to the food preparer. This second instruction may be presented with greater urgency to the food preparer via the monitor and accompanied by an appropriate audible alert. If the food preparer still does not respond in a timely manner to the second instruction within a predetermined second response time (as indicated by the failure of the system to sense the required action), the logic can further be configured to deliver an additional extremely urgent message to the food preparer and/or send a management alert message to another location (e.g., on-site or off-site manager's computer).

[0173] If the test in step **960** indicates that the placement sensor has been activated, step **970** is executed in which the cooking timer is initialized. Next, the system starts the cooking process in step **980**.

[0174] In step **985**, a test is performed to determine if the required total cooking time took has elapsed, thereby indicating that food product **906** is finished cooking. If the total cooking time T_{cook} has not elapsed, control passes to step **986** which performs a test to determine if the placement sensor has been deactivated. If the sensor has been deactivated, this indicates that the food preparer has prematurely withdrawn the cooking basket **904** from the fryer **900** before the food product **906** has finished cooking. This is a common problem when restaurants are very busy and food preparers are anxious to provide food products to the customers. However, such premature withdrawal can result in inadequately cooked food being served to consumers. In response to finding that the sensor has been deactivated, an audiovisual indicator, which may be either an audio warning or a visual message displayed on a CRT as shown in step **987**, may be provided indicating that the cooking is incomplete. This indicator may be provided to alert the food preparer and/or management. Step **988** is then executed in which the system identifies the food preparer making the error, and logs the date, time, and other pertinent monitored details of the event (e.g., food product removed 5 minutes early from fryer). The food preparer responsible for operating the fryer will have previously been identified to the system by data input from either the restaurant management (e.g., shift charts) or the food preparer (e.g., at the start of the shift). It should be noted that the restaurant management can decide precisely what parameters and information it wishes to track, and then program the system to record that information accordingly. In step **989**, the system stores the event-related information in a database which can later be recalled and displayed by the supervisor or management to determine the employee involved and appropriate action. Optionally, the system can provide real-time notification of this information to a remote location by using the capabilities of the system to transmit the data by cellular, digital, Internet, or other wireless communication means; conventional telecommunication means via modem access, or over conventional Internet connections. This will particularly advantageous where management oversees the operation of one or more restaurants from a remote location.

[0175] Returning to step **985**, if the total cooking time t_{cook} has elapsed, an audiovisual indicator, which may be either an audio warning or a visual message displayed on a CRT as shown in step **990**, may be provided instructing the food preparer to remove the cooking basket **904** from the fryer **900** because the food product **906** is finished cooking. This may be accompanied by an audible alert initiated by the

system Control is then returned to step **940** to await receipt of another cooking instruction

[**0176**] It should be recognized that the system is not limited to verification of manual tasks associated with cooking food, but may be used to verify the completion of any equipment-related manual tasks such as maintenance and other procedures e g , changing or filtering of shortening or oil used in deep vat fryers To verify that proper shortening or oil maintenance has been performed, the system control logic may be programmed to record various parameters such as the actual time it took for an employee to drain, clean, and refill the fryer with new shortening or oil The system can then compare this information to preprogrammed baseline time durations normally associated with completing these tasks properly If the comparison indicates these tasks were completed in less time than the baseline values, the maintenance operations could not have been properly performed The system may also be programmed to monitor the temperature of the cooking medium (i e , oil or shortening), for example, by a temperature probe located in the vat which is normally immersed while the fryer is in an operable condition If the fryer is fully drained (as it should be) during maintenance, the temperature probe should become exposed to air and the system should see temperatures approaching ambient conditions If the fryer vat has only been partially drained by an employee, the probe will not be exposed to air and higher than ambient temperatures will be sensed by the system, thereby indicating that the maintenance was not properly performed

[**0177**] It should be recognized that the system is not limited to the use of any particular type of sensors **906** to verify the completion of manual equipment related tasks Depending on the specific manual task to be verified which is a matter of design choice, the system may be provided with and rely on any suitable sensor whose selection and application will be well known to those skilled in the art (e g, temperature sensors, flow detectors, etc) Moreover, it is not necessary that the system be provided with any discrete sensor at all and may in fact measure various equipment operating parameters, for example, such as current (amps) draw, to obtain the information necessary to verify that a manual task has been performed involving the equipment

[**0178**] Virtual Hold Timer

[**0179**] The system of the present invention may also be used to establish a "virtual timer" to track the hold times for food after it has been cooked In one embodiment, for example, the system may be used to track hold times for fried chicken that is prepared in a deep vat fryer. This embodiment may be understood by reference to **FIG. 9A** described above and **FIG. 10A** which depicts exemplary control logic that may be used to create a virtual timer This control logic may reside and be implemented in a kitchen base station or the control center, at the system user's discretion

[**0180**] Referring now to **FIG. 10A**, logic process **1000** begin with step **1005** In step **1010**, the system receives a signal that a batch of food, for example fried chicken, has finished cooking ("cooking complete" signal) This signal may be triggered in the system by a food preparer manually depressing a button on the fryer controller affirming that the chicken has been removed from the fryer after the cooking cycle is completed Alternatively, the system may automatically detect the removal of the fryer basket by deactivation of a placement sensor **906** (as shown in **FIG. 9B**) whose function is described above with reference to another embodiment of the invention shown in **FIG. 9C**

[**0181**] Once the Cooking Complete signal is received, the system automatically assigns a Batch Identification Number (BID) to that batch of food, which has been prepared in one of the fryers **901** (reference **FIG. 9A**) in step **1015** The BID will be used to track the batch of food in its movement through the restaurant's various holding areas **902** and **915** (**FIG. 9A**) until it is either sold and delivered to the consumer or discarded (if the batch hold time has expired) The system generates a signal in step **1016** representing the BID and displays the BID in step **1017** on a local CRT display located near the fryers **901** The employee will use the assigned BID for entry into the system upon subsequently moving the food product throughout the restaurant Of course, the BID may optionally be manually assigned by the employee

[**0182**] The restaurant employee next places the batch of cooked food in one of the food holding areas **902** or **915** (**FIG. 9A**) Upon placing the food in a food holding area, the employee reads the BID (e g , FCHK3 representing the third batch of fried chicken prepared on a given day) off of the CRT display associated with the cooking/preparation appliance and enters this information into the system via an alphanumeric keypad **916** (**FIG. 9A**) that may be provided with the holding areas **902** or **915**. Preferably, the keypad **916** is capable of wireless communications with the system and need not be physically a part of the food holding areas **902** or **915** Alternatively, the employee may enter the BID into the system via any available data entry means which may be provided with the system such as an alphanumeric keyboard, voice recognition system, hand-held wireless data entry devices that are in communication with the system (e g , similar to those used for inventory control or completing mobile POS purchase transactions), or any other suitable device The type of data entry means used is a matter of design choice

[**0183**] The holding area keypad **916** may be linked to and communicate with the system by either a wireless or conventional hard-wired data communication link The use of wireless communication links between a keypad and a main system are well known not only in the food preparation industry, but also in the wireless premise intrusion alarm system art Such keypad devices may operate off standard 120 volt AC hard wired power supplies or off of battery power It should be recognized that the employee may select the holding area in which to place the food, or alternatively, the control logic of the system may be programmed to automatically select a holding area and then deliver an instruction to the employee to place the food in the area selected by the system, displaying the BID on the CRT associated with the holding area where its supposed to be placed In this instance, a variation of the logic of **FIG. 9C** can be used to verify that the appropriate batch of food has been put there It will be apparent that the cooked food may be placed in any available (unoccupied) holding area **902** or **915** Each holding area is assigned it own unique designation code (e g, FHB_1, $FHPOS_3$, etc) by the restaurant management as illustrated in **FIG. 9A** These holding area designation codes are pre-programmed into, and are recognized by, the system The keypad **916** may be provided with a

visual display or readout which identifies the BID of the food product which has been placed in that respective food holding area Alternatively, this information may be shown on a system CRT display that may show several food holding area designation codes and the BID of food products that reside therein

[0184] With continuing reference to **FIG. 10A**, in step **1020**, the control logic next creates a link and associates the holding area designation code with the BID by virtue of the employee entering the BID into the system via the holding area keypad (or the system assigning the hold area to be used and instructing the employee to place the cooked food there) as described immediately above For example, the employee may place fried chicken BID FCHK3 in holding area FHB_1, and enters the BID into the keypad at holding area FHB_1 It should be recognized that the keypad may be an integral part of and physically attached to the holding area device during its manufacture, or the keypad may be a separate, stand alone unit that is added later to the holding area setup

[0185] In logic step **1025**, the system next determines the proper hold time at a particular holding temperature for the type of food product that has been prepared (here, for example, fried chicken) To make this determination, the control logic accesses a database into which hold times as a function of holding temperature have been entered by restaurant management for all the various types of food products that a given restaurant might prepare This database may reside within the local base stations or at the control center For example, the control logic may read a database entry that indicates the maximum hold time for fried chicken held at a temperature of 110 degrees Fahrenheit is 60 minutes It should be recognized that hold times may be stored in tabular form in the database with discrete entries of temperature and hold times Alternatively, hold time information may be stored in the system database as a set of curves in the form of hold times versus temperature The stored hold time information may include an "offset" such that any warning generated in connection with the expiration of the hold time will sufficiently precede the actual hold time expiration to allow appropriate steps to be taken (i e , an "advance notification" time). This aspect of the invention will be further described below in conjunction with **FIG. 10B**.

[0186] Once the proper hold time has been determined in step **1025**, the control logic next starts a hold timer in step **1030** which begins counting down the remaining hold time for the particular batch of food in question This "virtual" hold timer will continue to monitor the elapsed time for the food product with its associated BID as the food is physically moved through the restaurant by the employees as described below

[0187] In logic step **1035**, a test is performed to determine if the hold time has elapsed for the batch of food being tracked If the hold time has not elapsed, step ,036 executes a test to determine if the food product batch has changed holding area locations For example, if batch of fried chicken BID FCHK3 is moved from its initial back kitchen holding area (FHB_1) to point of sale holding area $FHPOS_2$, the employee enters BID FCHK3 into the holding area keypad associated with $FHPOS_2$ The system would therefore receive information that BID FCHK3 is now in holding area $FHPOS_2$ instead of FHB_1 Thus, using this example, the control logic performing the test in step **1036** would return a positive answer that the hold area location has changed for BID FCHK3 In this case, control is returned to step **1020** which records in the system the new, changed holding area location associated with batch of fried chicken BID FCHK3 Since hold times may differ according to such factors as the holding temperature, for example, the remaining hold time for the new location is recalculated in step **1025** factoring into the calculation any time already expended in the previous holding area location The logic process then continues with steps **1030** and **1035** as described above

[0188] If in step **1036** a negative response is initially returned to the test indicating that the food holding area location has not been changed, control is returned to step **1035**

[0189] If in step **1035**, however, the hold time is found to have elapsed, step **1040** is executed, generating a signal indicating that the hold time has expired for the batch of food (BID FCHK3 using the above example) Responsive to the signal generated in step **1040**, an audiovisual indicator, which may be either an audio warning or a visual message displayed on a CRT as shown in step **1041**, may be provided indicating that the hold time has expired and that the batch of food should be discarded Control is then returned to step **1010** ready to begin the logic process again

[0190] **FIG. 10B** depicts an additional embodiment logic process **1050** (which is a variation of logic process **1000**) that is directed to assisting a restaurant in controlling inventory of its cooked food products The system can perform this function by sensing that the hold time for a batch of food will soon expire, and then sending advance instructions to cook more of that particular food This allows restaurant management and employees enough advance warning to prepare additional batches of food which will be ready in time to replace the soon-to-expire batch of food, thereby ensuring that consumers' demand for that particular food item can be met without undue delay and consumer dissatisfaction

[0191] Referring to **FIG. 10B**, after the test in step **1035** is performed (**FIG. 10A**) and a negative response is returned, control passes in step **1049** to step **1055** which is performed in parallel with step **1036** (**FIG. 10A**) In step **1055**, the system selects the proper advance notification time t_{notif} that has been previously input into a database accessible to and residing in the system by the restaurant management This database may reside in the base stations or the control center Time $t_{notif.}$ generally represents the amount of lead time required to both prepare and cook a replacement batch of any particular food product, and may be empirically determined For example, the advance notification time t_{notif} to prepare and cook fried chicken may be twenty minutes

[0192] In step **1060**, the remaining hold time t_{rem} is calculated by reference to the batch hold timer which is initiated in step **1030** (**FIG. 10A**) In step **1065**, a test is performed to determine if an advance notification message should be delivered to start preparation of another batch of food to replace the food whose hold time will soon expire This is accomplished by comparing the advance notification time t_{notif} with the remaining hold time t_{rem} If in step **1065** t_{rem} is greater than $t_{notif.}$, step **1042** is executed which transfers control back to step **1035** in logic process **1000** (**FIG. 10A**) If in step **1065** t_{rem} is equal to or less than $t_{notif.}$

step **1070** is executed which generates a signal instructing employees to cook more food Responsive to the signal generated in step **1070**, an audiovisual indicator, which may be either an audio warning or a visual message displayed on a CRT as shown in step **1075**, may be provided instructing employees that another batch of food should be prepared and cooked to replace the food whose hold time is about to expire. Optionally, as shown in step **1066**, the system and control logic may be configured such that an advance notification message signal is also generated and accompanied by an audiovisual indicator advising employees of the time when the food hold time will expire A visual message may be displayed showing the number of minutes in the future when the hold time expires (e g , 20 minutes), the real time of day (e g , 2p m), or both

[0193] It will be appreciated by one skilled in the art that with the networking capability of the invention, logic process **1050** could be modified and customized in a number of different ways to assist a restaurant in managing and controlling its inventory of cooked food products For example, optional logic process **1080** in **FIG. 1013** is a variation of logic process **1050** which is directed to checking available cooked food product inventories in a restaurant before instructing employees to cook additional batches of food Logic process **1080** begins with the results of the test performed in step **1065** of logic process **1050** Based on obtaining a negative result for the test in step **1065**, step **1085** is executed which is a test to determine if a replacement batch of food product (for the batch whose hold time will soon expire) is already available either in the process of being cooked or in another hold area Since the system is capable of communicating with cooking appliances connected to communication network of the system, the system can readily determine what food products are in the process of being cooked and their expected cooking completion times If in step **1085** the system finds another batch of the food product available, control passes to step **190** which stops logic process **1080** This prevents the possibility that a replacement batch of food will be unnecessarily cooked resulting in an inventory of that particular food product in excess of consumer demand This undesirable situation would mean that the excess food would eventually be discarded after its hold time expires and increase operating costs for the restaurant If in the test of step **1085** a replacement batch of cooked food product is not found in the restaurant, steps **1086** and **1087** are executed which are identical to steps **1070** and **1075**, respectively, which generates a signal and audiovisual indicator advising employees and/or management that an additional batch of food should be cooked

[0194] Shortening Management/Fryer Maintenance Management

[0195] The system of the present invention may also be used to provide networked and integrated management, including maintenance (e g , changing and filtering of oil or shortening), of a plurality of fryers at a given restaurant location In one embodiment of the invention, the system may be used to balance multiple fryer usage and to schedule the maintenance of the various fryers to ensure that a maximum number of fryers are available for service during peak demand periods for food Exemplary control logic which may be programmed into in the system of the invention to balance fryer utilization and maintenance is shown in the flowchart of **FIG. 11**. This control logic may reside and be implemented in a kitchen base station or the control center, at the system user's discretion

[0196] Referring to **FIG. 11**, logic process **1100** begins with step **1110** In step **1111**, the control logic is preprogrammed with baseline fryer maintenance data that is used to determine the maximum number of fryer cooking cycles desirable for each fryer before changing or filtering of the cooking medium is required This baseline data may include, but is not limited to: the type of food products cooked, time durations for both active cooking and idle time, cooking temperatures, types of cooking medium that may be used (e g , shortening, vegetable oil, canola oil, etc), and other parameters which are at the restaurant management's discretion to be used for determining when fryer cooking medium maintenance is required The baseline data may be readily determined by empirical methods and from experience in the restaurant industry In step **1112**, the control logic is also preprogrammed with the time durations necessary to complete a maintenance cycle such as changing or filtering the cooking medium (i e , maintenance downtime) This data will be dependent on the specific brand or type of fryers used and their design characteristics (e g , volumetric capacity of the fryer vat, cooking medium pump flowrate, etc).

[0197] It should be noted that the baseline data discussed above in steps **1111** and **1112** may be preferably stored in a database accessible to the system and may reside either in the local kitchen base stations or the remotely located control center

[0198] Continuing with the logic process in step **1120**, the system next reads historical sales data maintained by the system to determine the demand for various types of food products (i e , fried chicken, french fries, fried fish, onion rings, etc) served at a specific restaurant location for a given day of the week and time of day This data may be stored and updated in a database residing in the system either in a local kitchen base station or at a remotely located control center. This information is preferably collected by the POS (point of sale) system for a specific restaurant since demand for various types of food will differ by the geographic location of the restaurant and preferences of the consumers it serves

[0199] In step **1130**, the system monitors and determines the actual usage of individual fryers at a particular restaurant location or cell as shown in **FIG. 1** in this step, relevant data on actual operating conditions is collected and read by the system for each fryer. This data will be used by the system to determine when the cooking medium for each fryer will require maintenance and the type of maintenance operation required (i e , cooking medium changing or filtering) This may include, but is not limited to, the number of cooking cycles actually completed since the last cooking medium filtration or changing, elapsed time of fryer usage, fryer idle time and temperature of cooking medium while idle, cooking cycle temperatures, type of food cooked, and other data which will be used by the system to determine when the cooking medium requires changing or filtering The actual usage information on each fryer may be tracked and stored by each individual appliance microprocessor controller, a local kitchen base station, a remotely located control center, or any combination of the foregoing It should also be noted that if a fryer is broken and unavailable for service, the system would identify the fryer's unavailability during step

1130 as well. Therefore, the broken fryer or fryers would not be factored into the subsequent logic step determinations described below

[0200] In step 1140, the predicted time when each fryer will require maintenance and the expected duration of the maintenance is determined for each fryer at a given restaurant location by using the baseline data pre-programmed into the system in steps 1111 and 1112, and the actual operating data obtained by the system for each fryer in step 1130

[0201] Step 1150 continues the control logic with the system utilizing the historical sales data read in step 1120 to forecast or predict the expected demand for each type of food product served at a specific restaurant location at any given time of day for any given day of the week The system thus generates demand profiles for each type of food product consisting of the quantity sold versus the time of day for a given day of the week For example, therefore, the system may know that consumer demand for fried fish may peak at noon on Fridays, while the demand for fried chicken is maximum at six o'clock in the evening on the same day The demand profiles generated by the system are preferably updated on a continuing basis using the historical sales data from the POS system, to ensure the most accurate food product demand forecasts can be made It should be recognized that there will typically be more than one period during any given day when food product demand in general will peak for any given product, typically there are two peaks (lunchtime and dinnertime) Optionally, the system may also read in historical food product demand data from past years to reflect seasonal changes in food product ordering habits of consumers where it is known by restaurant management that such seasonal variations exist Thus, it is apparent the system is extremely flexible and the type of data used by the system in generating food product demand profiles is controlled by and at the discretion of restaurant management

[0202] Proceeding to logic step 1160, the predicted maintenance timing (time of day), duration, and type of operation required (i e , filtering or changing of the cooking medium) for each fryer as calculated by the system in step 1130 is compared with the demand forecast for each type of food product served at the restaurant on a given day of the week as determined in step 1150 This allows the system to determine if a sufficient number of fryers will be available to meet the upcoming peak demands for the various types of food products being served

[0203] Still referring to FIG. 11, the logic process is continued in step 1170 wherein the system schedules the timing of all fryer maintenance operations at the specific restaurant location based on their maintenance requirements determined in the preceding logic steps Preferably, the maintenance cycles are planned to ensure that a sufficient number of fryers are available for service to meet peak demand periods for the various type of food products being served Accordingly, the maintenance operations are preferably scheduled to coincide with off-peak periods of food product demand to the extent possible When it is time to run a maintenance procedure on a specific fryer, the system next generates and delivers a signal in step 1180 containing that information In restaurants which have fully automated fryer maintenance operations, the signal generated is a control signal which automatically initiates the required maintenance operation. Where fryer maintenance operations are initiated manually by restaurant employees, the signal generated is an information signal which provides notification via a message display to the employees to initiate a maintenance cycle This informational signal would identify the specific fryer and type of maintenance operation required (e g , "change cooking medium" or "filter cooking medium") The information can be displayed on a local CRT display and may be optionally accompanied by an audible alert which is also generated by the system to coincide with the delivery of the informational maintenance message Following step 1180, control is returned to step 1120 which continues logic process 1100

[0204] It will be recognized by those skilled in the art that the control logic depicted in FIG 11 can be modified in any number of ways to suit the individual needs and preferences of various restaurant establishments For example, the control logic may include steps to balance fryer utilization by allocating and scheduling the cooking cycles among various fryers at a specific restaurant location The system would thus instruct the employees as to which fryers to use for which food products at any given period during the day These instructions may be displayed on local CRT displays associated with the fryers Balancing fryer utilization would help to further ensure that a maximum number of fryers are available to meet peak demand periods for food

[0205] With respect to the foregoing embodiments of the invention which have been described, it should be recognized that communications, whether between the individual appliances, base stations, control center, or any combination thereof, may be accomplished by any suitable wireless or wired means for the intended application and is a matter of design choice Preferably, communications are effectuated through wireless communication platforms whose technology is well established and known to those skilled in the art More preferably, the wireless communications are performed over the Internet using established nationwide wireless networks However, the Internet links may also be conventional, wire-based connections such as through standard telecommunication lines, DSP lines, T1 service, etc

[0206] It will also be appreciated by those skilled in the art that individual appliances and base station local networks may be communicated with via any of the numerous mobile communication devices prevalent in today's electronic technology These devices may include, but are not limited to, cellular and other wireless communicating devices which may be embodied in a phone-type platform, laptop or notebook computers, personal digital assistants (PDAs) or Pocket PCs, etc Accordingly, for example, these devices may be used to upload or download data, control appliance and base station operations including food preparation and maintenance, monitor appliance status and sales, etc , all from a remote location These communication devices may effectuate contact with the appliances or base stations via wireless Internet connections using established nationwide wireless networks

[0207] It should be noted that no system is perfect, and employees may always manage to find ways to cheat Moreover, there is always some degree of human involvement in any automated process at some point, especially in operating a food service establishment Accordingly, there is no system that can, with 100 percent certainty, "verify" full

compliance is being actually achieved at all times The present invention, however, surpasses systems of the past because it is based more heavily on empirical data and actual measurement of objective parameters to verify that tasks are properly being completed

[0208] It should further be recognized that the invention is not limited to the particular embodiments described above Accordingly, numerous modifications can be made without departing from the spirit of the invention and scope of the claims appended hereto For example, it will also be appreciated by those skilled in the art that the invention is not limited to restaurant applications, but may be employed in any commercial, institutional, or residential application wherein appliances are used Moreover, the invention is not limited to use with any particular type of food product or appliance, and will find broad applicability in the food preparation and service industry wherever the invention may be feasiblely employed Thus, the invention may be used with ovens, ice machines, dishwashers, refrigerators, heating and air conditioning units, etc which may be provided with microprocessor-based controllers to provide a communication interface with the system and network of the invention Accordingly, these appliances may be "Web-enabled" to effectuate communications with the system via the Internet

1-47 (canceled)

48 A communication system for monitoring the operation and maintenance of at least one kitchen appliance, comprising:

a control center;

a database, operatively coupled to the control center, containing data related to said at least one kitchen appliance; and

a communication network interconnecting said at least one kitchen appliance with said control center,

wherein said system, responsive to data regarding the operation and maintenance of said at least one kitchen appliance, prepares at least one of accounting or billing reports for said at least one kitchen appliance, said communication system further comprising a point of sale system accessing said at least one of accounting or billing data from said database, said point of sale system directing the transfer of funds associated with the service of a specific one of said at least one kitchen appliance, from a user's financial institution to an agency's financial account performing the service

49 The communication system of claim 48, further comprising a repair vehicle, said repair vehicle in communication with said control center, said control center dispatching said repair vehicle in response to said data regarding maintenance of said at least one kitchen appliance

50 The communication system of claim 49, wherein a repair is effected as a result of dispatching said repair vehicle and said billing data is a bill for said repair

51 The communication system of claim 48, wherein data regarding the operation and maintenance of at least one kitchen appliance is the monitoring of the degradation of said at least one kitchen appliance

52 The communication system of claim 51, wherein said control center causes a message to be displayed at said at least one kitchen appliance if said degradation exceeds a predetermined level

53 The communication system of claim 51, wherein said control center disables said at least one kitchen appliance when said degradation exceeds a predetermined level

54 The communication system of claim 51, wherein said control center communicates with said at least one kitchen appliance to change an operational parameter of said kitchen appliance to compensate for said degradation

55 The system of claim 48, wherein said communication network is a wireless network

56 The communication system of claim 48, further comprising a handheld terminal, communicating with said control center and said kitchen appliance

57 The communication system of claim 56, wherein said control center prepares and transmits an invoice to said handheld terminal upon completion of maintenance for said at least one kitchen appliance

58 The communication system of claim 48, wherein said data includes a serial number associated with said kitchen appliance

59 A communication system for monitoring the operation and maintenance of at least one kitchen appliance, comprising:

a control center;

a database, operatively in communication with said control center, containing at least one of accounting and billing data for said at least one kitchen appliance; and

a communication network interconnecting said at least one kitchen appliance with said control center,

wherein said system, responsive to data regarding the operation and maintenance of said at least one kitchen appliance, prepares at least one of accounting and billing reports for said at least one kitchen appliance, said communication system further comprising a point of sale system charging a user's financial account for expenses associated with service of said at least one kitchen appliance

60 The communication system of claim 59, further comprising a repair vehicle, said repair vehicle in communication with said control center, said control center dispatching said repair vehicle in response to said data regarding maintenance of said at least one kitchen appliance

61 The communication system of claim 59, wherein a repair is effected as a result of dispatching said repair vehicle and said billing data is a bill for said repair

62 The communication system of claim 59, wherein data regarding the operation and maintenance of at least one kitchen appliance is the monitoring of the degradation of said at least one kitchen appliance

63 The communication system of claim 62, wherein said control center causes a message to be displayed at said at least one kitchen appliance if said degradation exceeds a predetermined level

64 The communication system of claim 62, wherein said control center disables said at least one kitchen appliance when said degradation exceeds a predetermined level

65 The communication system of claim 62, wherein said control center communicates with said at least one kitchen

appliance to change an operational parameter of said kitchen appliance to compensate for said degradation

66. The communication system of claim 59, wherein said communication network is a wireless network

67. The communication system of claim 59, further comprising a handheld terminal, communicating with said control center and said kitchen appliance

68. The communication system of claim 67, wherein said control center prepares and transmits an invoice to said handheld terminal upon completion of maintenance for said at least one kitchen appliance

69. The communication system of claim 59, wherein said data includes a serial number associated with said kitchen appliance

70. A method of processing at least one of billing, accounting and diagnostic information for kitchen appliances wherein a plurality of kitchen appliances each transmits and receives data associated with their operating conditions to a control center and a point of sale system, comprising the steps of:

initiating service of a specific kitchen appliance upon the occurrence of a predetermined condition;

retrieving from said control center information associated with said specific kitchen appliance so as to thereby generate a repair invoice;

retrieving billing information from said control center for said specific kitchen appliance; and

transmitting said billing information to said point of sale of system, said point of sale system electronically transferring funds for the repair of said specific kitchen appliance from a user's financial account to an agency's financial account performing the repair

71. The method of claim 70, further comprising the steps of providing a repair vehicle in communication with said control center, said control center dispatching said repair vehicle in response to said data regarding maintenance of said at least one kitchen appliance

72. The method of claim 70, further comprising the step of effecting a repair as a result of dispatching said repair vehicle and said billing data is a bill for said repair.

73. The method of claim 70, further comprising the steps of monitoring the degradation of said at least one kitchen appliance

74. The method of claim 73, wherein said control center causes a message to be displayed at said at least one kitchen appliance if said degradation exceeds a predetermined level

75. The method of claim 73, wherein said control center disables said at least one kitchen appliance when said degradation exceeds a predetermined level.

76. The method of claim 73, wherein said control center communicates with said at least one kitchen appliance to change an operational parameter of said kitchen appliance to compensate for said degradation.

77. The method of claim 70, wherein said communication network is a wireless network

78. The method of claim 70, further comprising the step of communicating with said control center and said kitchen appliance from a handheld terminal

79. The method of claim 70, further comprising the step of updating at least one of the accounting, billing and maintenance in response to said service performed

80. The method of claim 76, further comprising the step of said control center sending software to said handheld terminal to effect one of maintenance and repair to said kitchen appliance

81. The method of claim 76, further comprising the step of storing at least one of payment history, maintenance history, appliance part inventory, customer data, repair history, malfunction history, and warranty records for said at least one kitchen appliance in said database

* * * * *

EXHIBIT H

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(54) AUTOMATED FOOD PROCESSING SYSTEM AND METHOD

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(52) U.S. Cl. 99/407

(57) ABSTRACT

An automated food processing system and method is provided that allows food to be dispensed, fried and packaged in a suitable container, which may be an individual portion-sized container. In one embodiment, the system includes separate automated modules for dispensing, frying and packaging the food.

In one embodiment, an automated dispensing device dispenser a predetermined portion of food from a bulk storage container or food dispensing magazine. Food is dispensed from the automated dispensing device to an automated fry device that can include at least one circular fry wheel having a plurality of food containing compartments. After the food is fried it is dispensed from the fry device to an automated packaging device. The automated packaging device dispenses food to a container that may be an individual portion-sized container that is retrieved, erected and held into position for filling by an automated container handling system. After a food container is filled, a conveyor system transports the filled container to a suitable pick-up location.

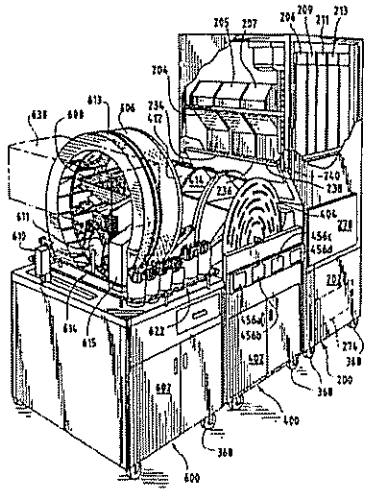

FIG. 1

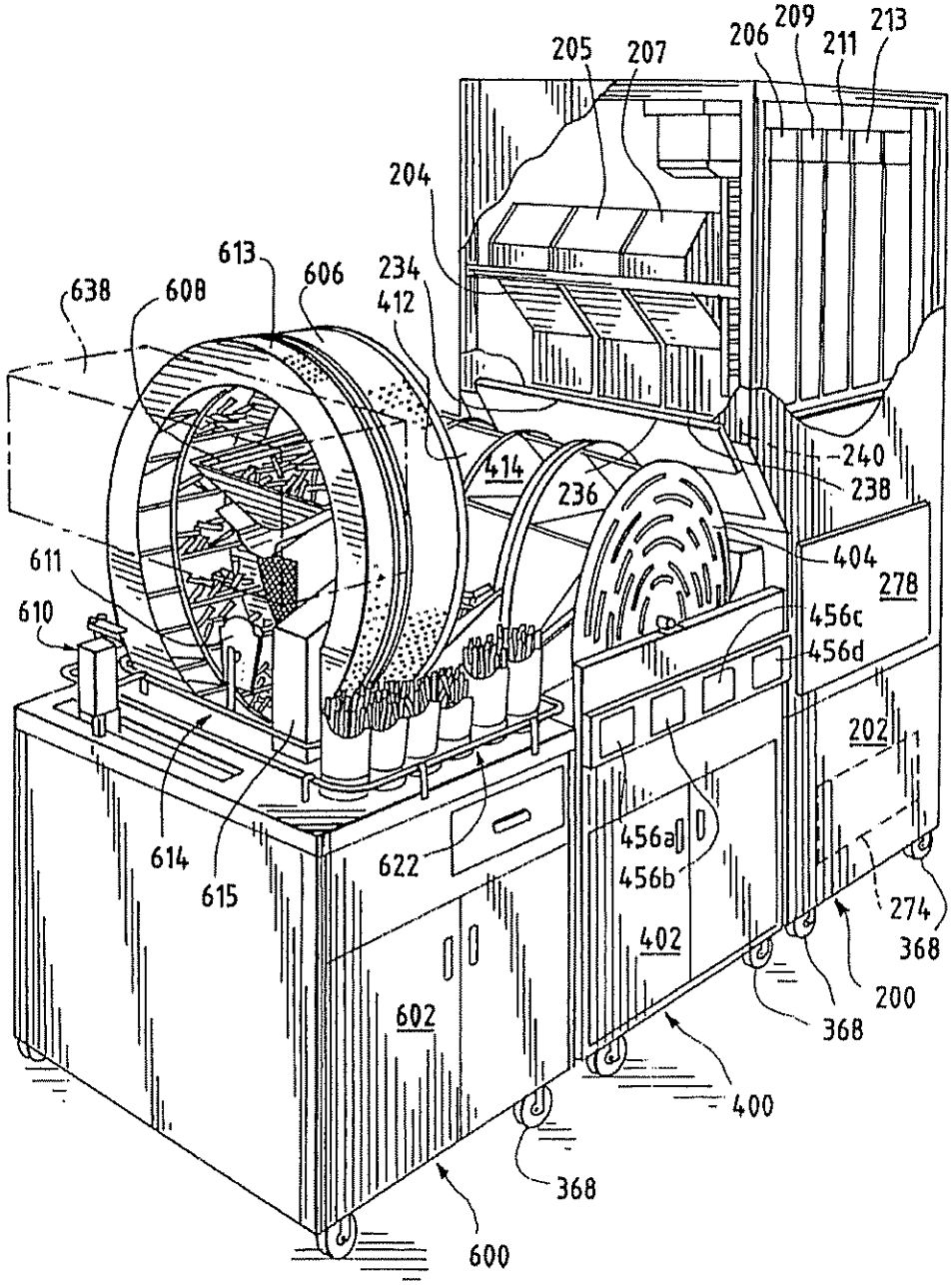
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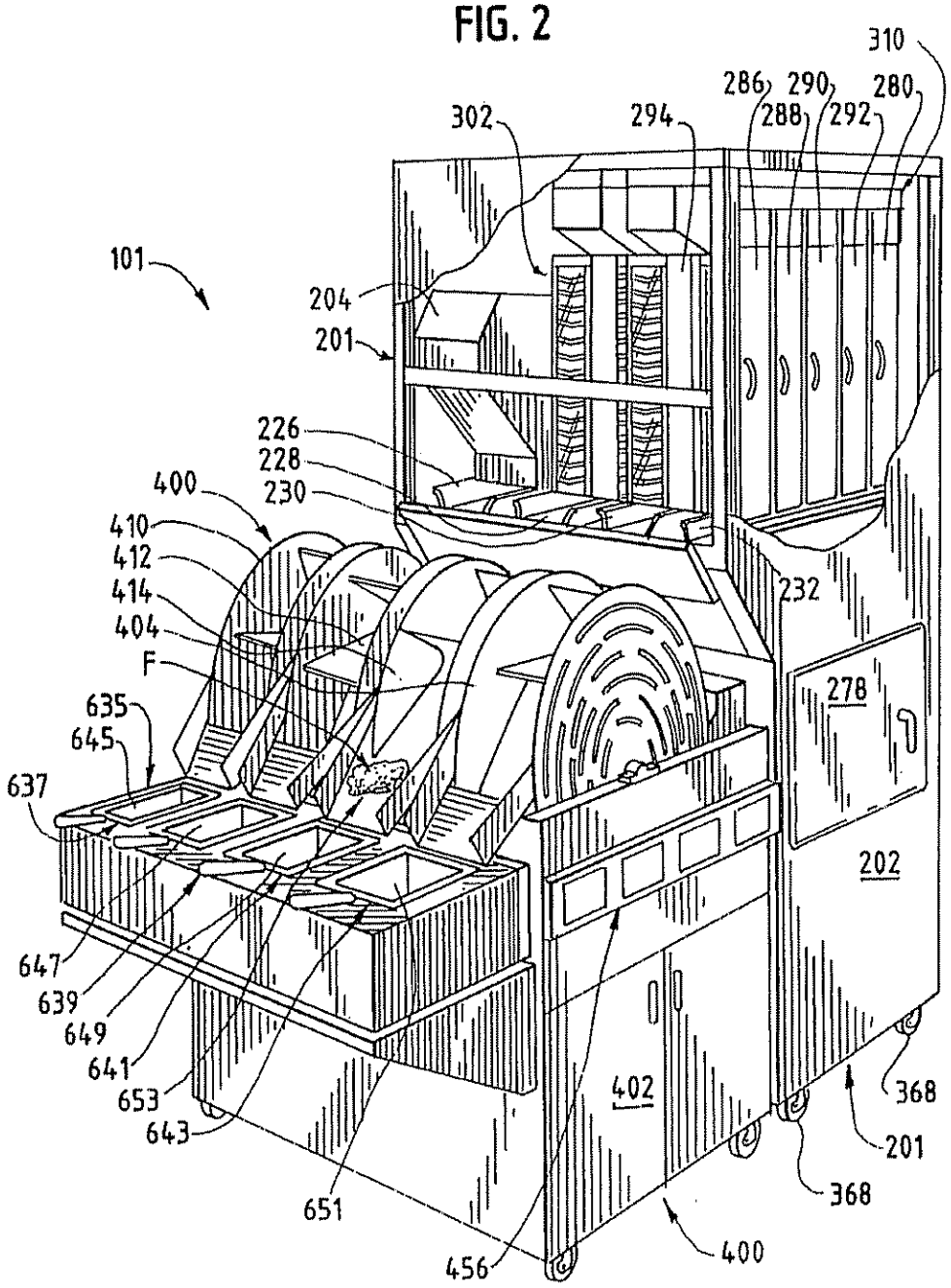
FIG. 2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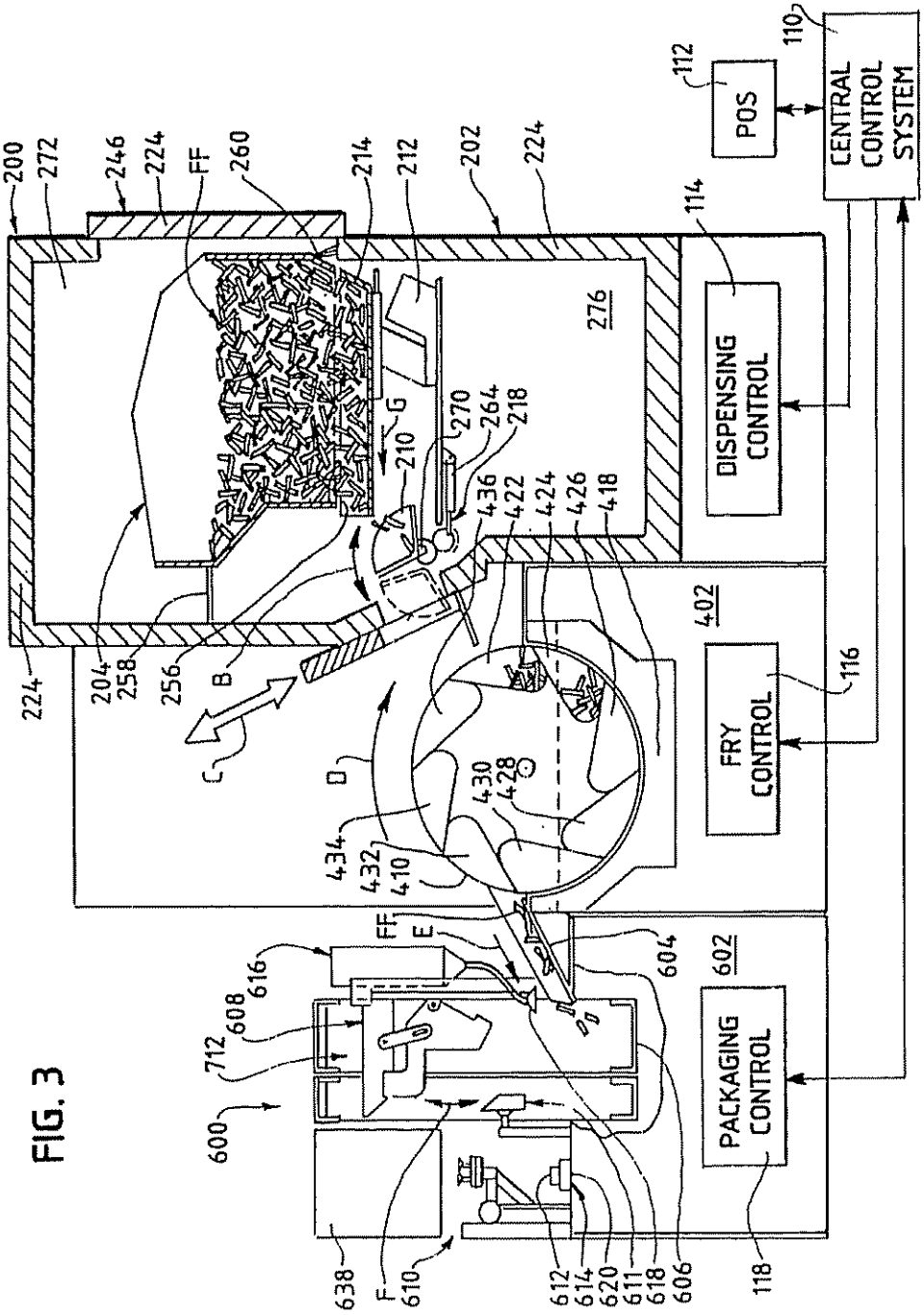
POS
CENTRAL CONTROL SYSTEM
DISPENSING CONTROL
FRY CONTROL
PACKAGING CONTROL
110
112
114
116
118
200
272
246
224
FF
260
214
212
202
276
G
270
264
218
210
436
422
424
426
418
402
204
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FIG. 3

FIG. 4

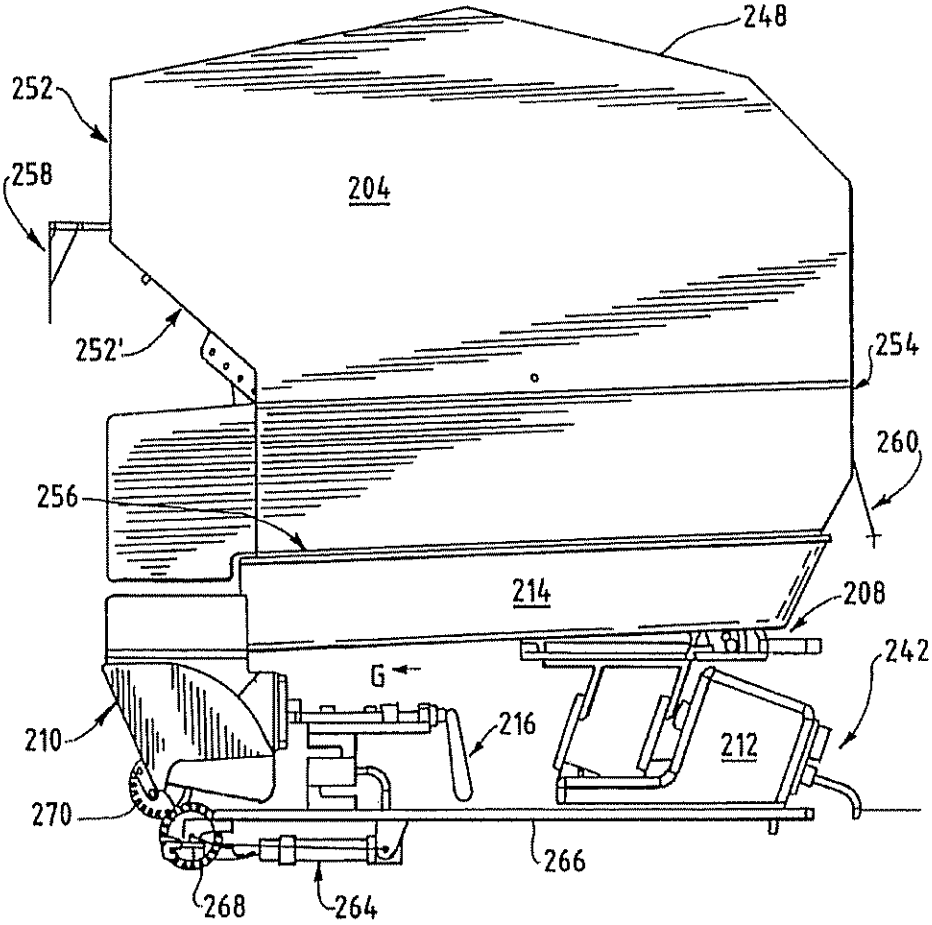
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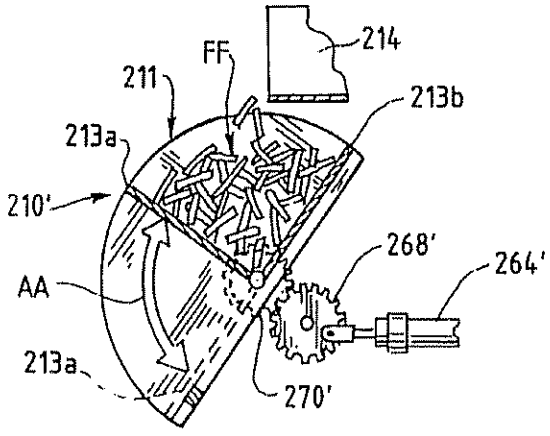
FIG. 4A


214
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211
213b
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210'
268'
264'
AA
213a
270'

FIG. 5

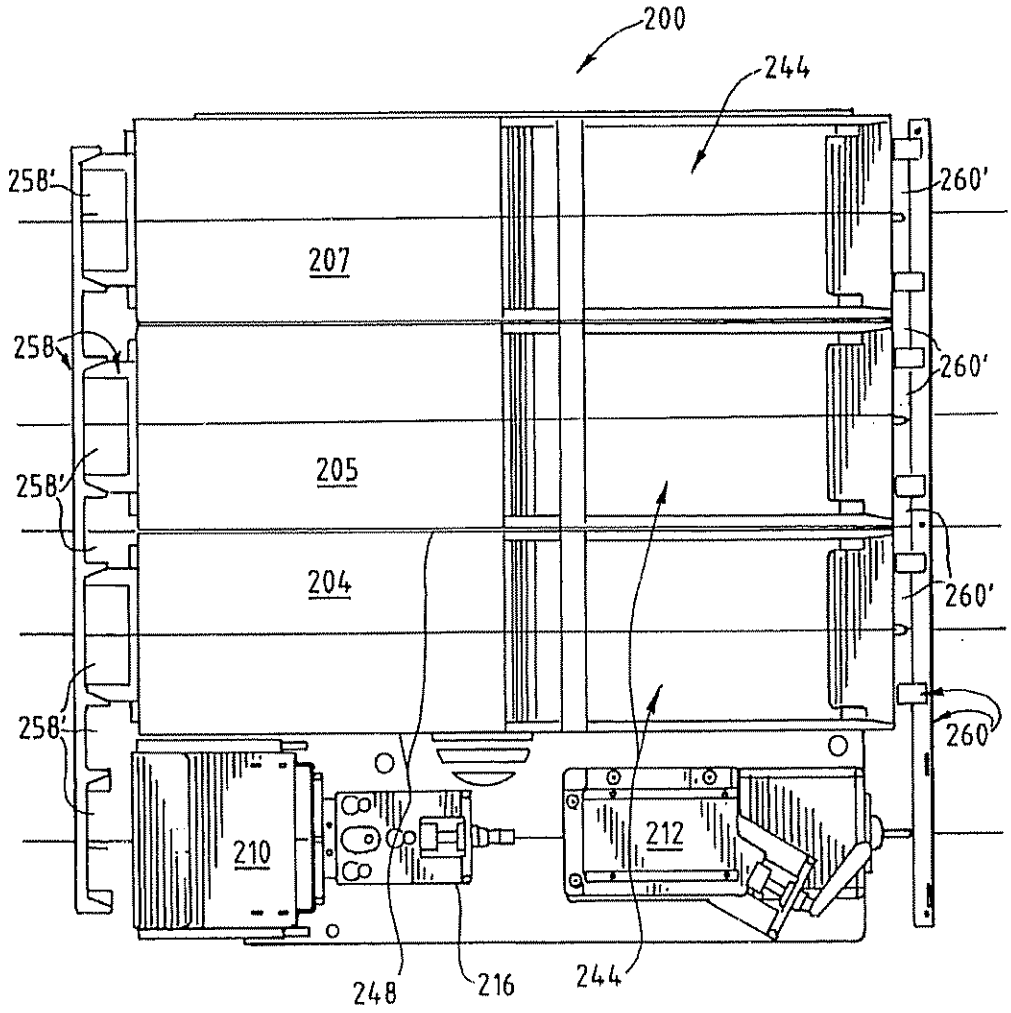

200
244
258'
260'
207
258'
260'
205
258'
204
260'
258'
260'
210
212
248
216
244

FIG. 6

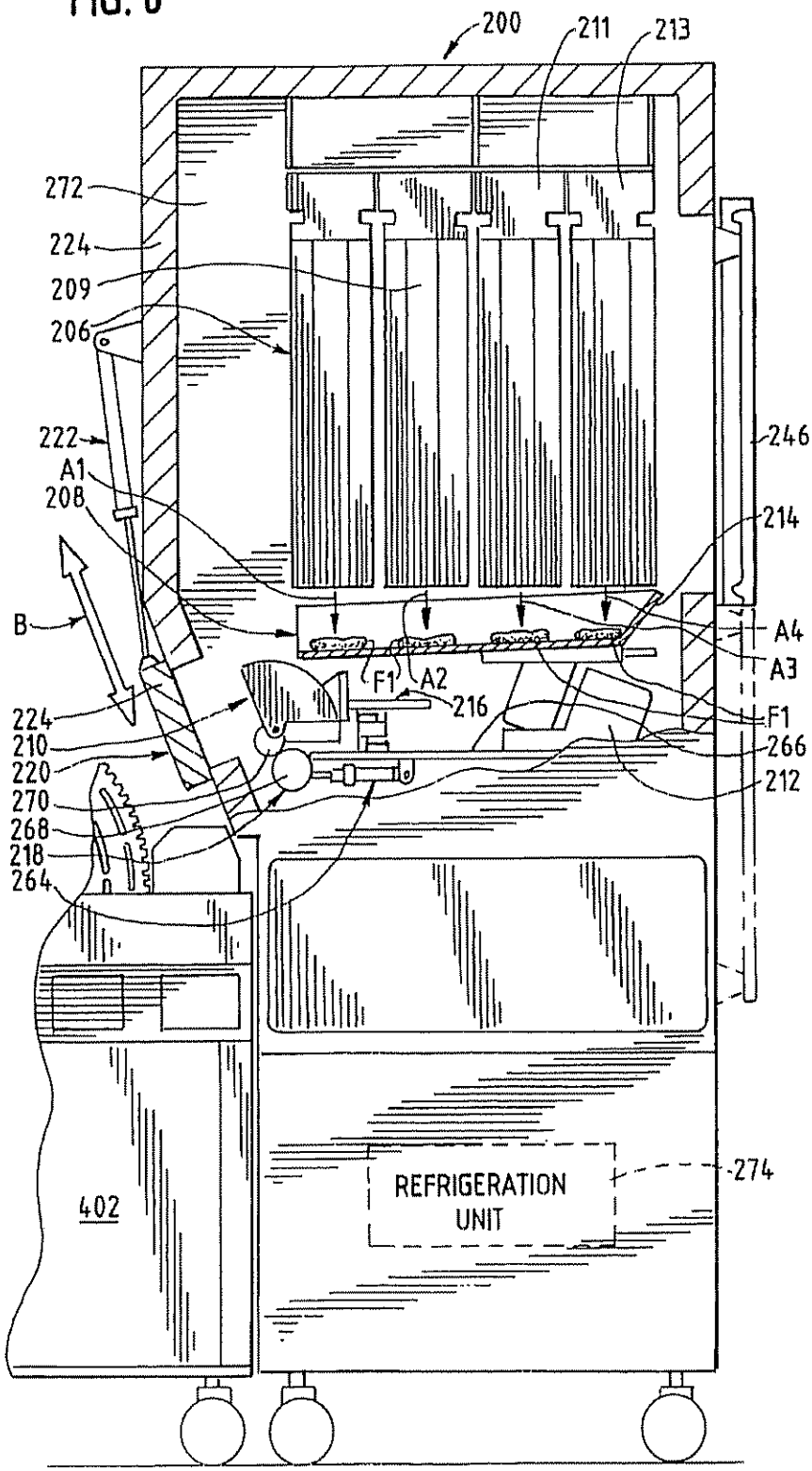

200
211
213
272
224
209
206
222
A1
208
B
224
210
220
270
268
218
264
246
214
A4
A3
F1
A2
216
F1
266
212
402
REFRIGERATION UNIT
274

FIG. 7

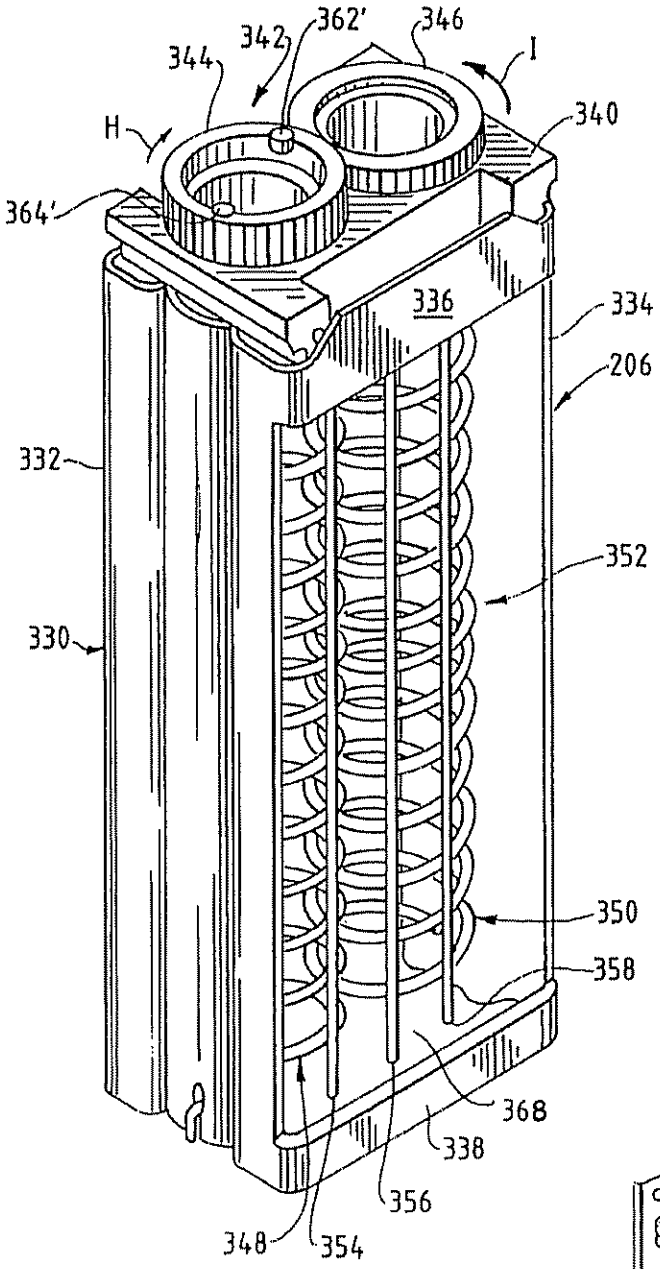

362'
342
346
344
I
H
340
364'
336
334
206
332
352
330
350
358
368
338
356
348
354

FIG. 8

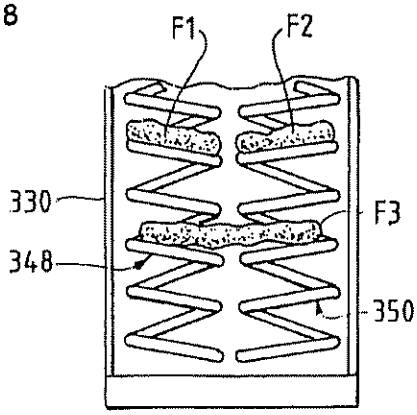

F1
F2
330
F3
348
350

FIG. 9

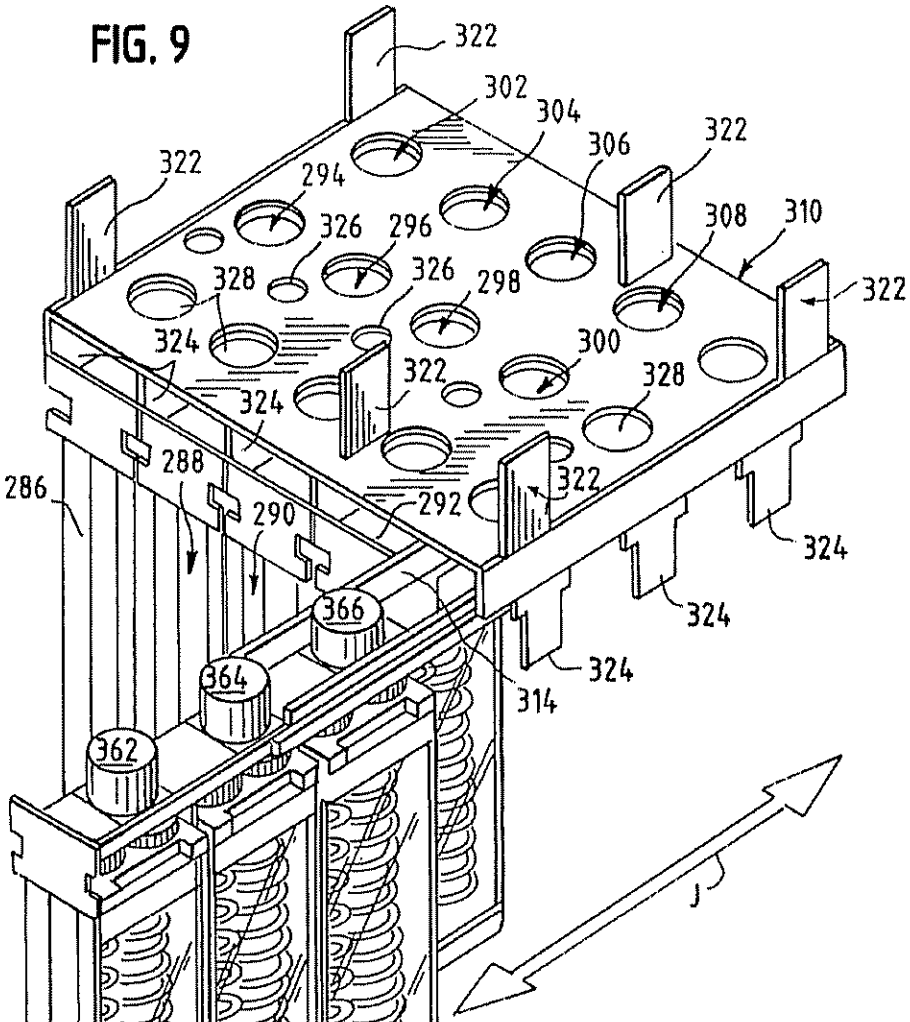

322
302
304
306
322
294
322
326
296
308
310
328
326
298
322
324
300
322
328
324
288
322
286
290
292
324
366
324
364
324
314
362
J
284
282
280

FIG. 10

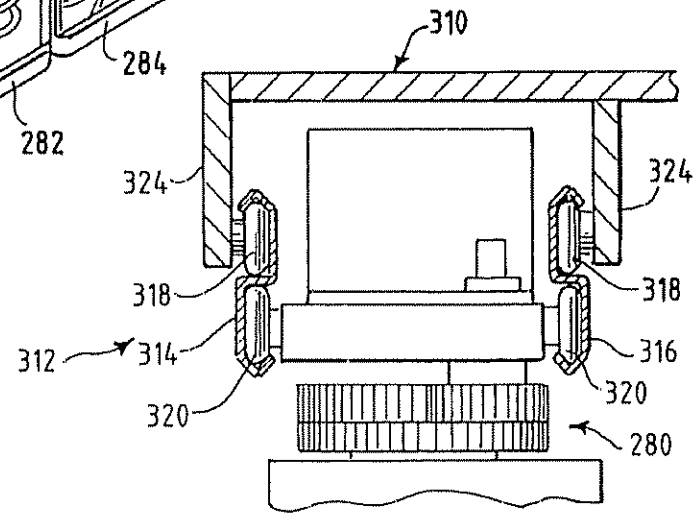

310
324
324
318
318
312
314
316
320
320
280

FIG. 11

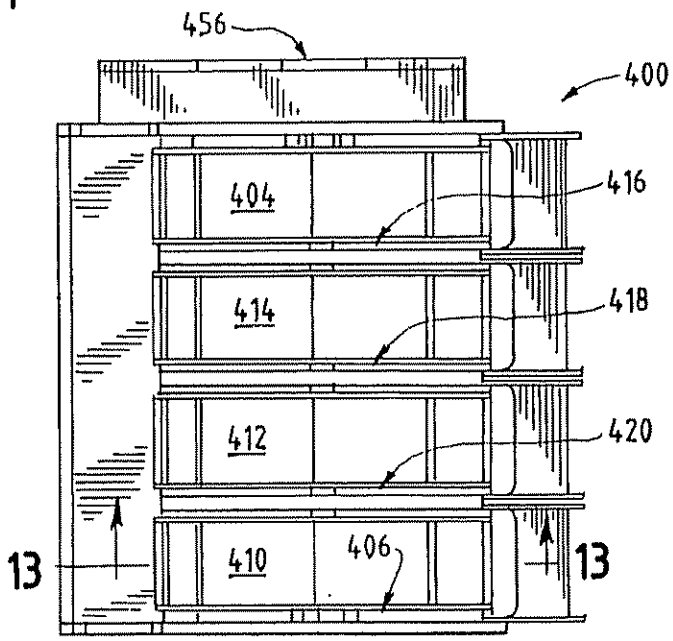

456
400
404
416
414
418
412
420
13
410
406
13

FIG. 12

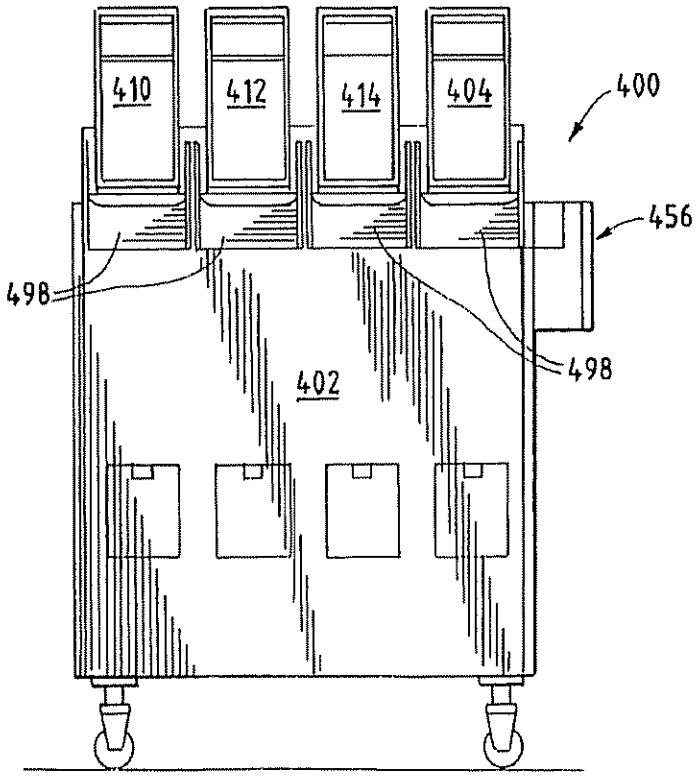

410
412
414
404
400
456
498
498
402

FIG. 13

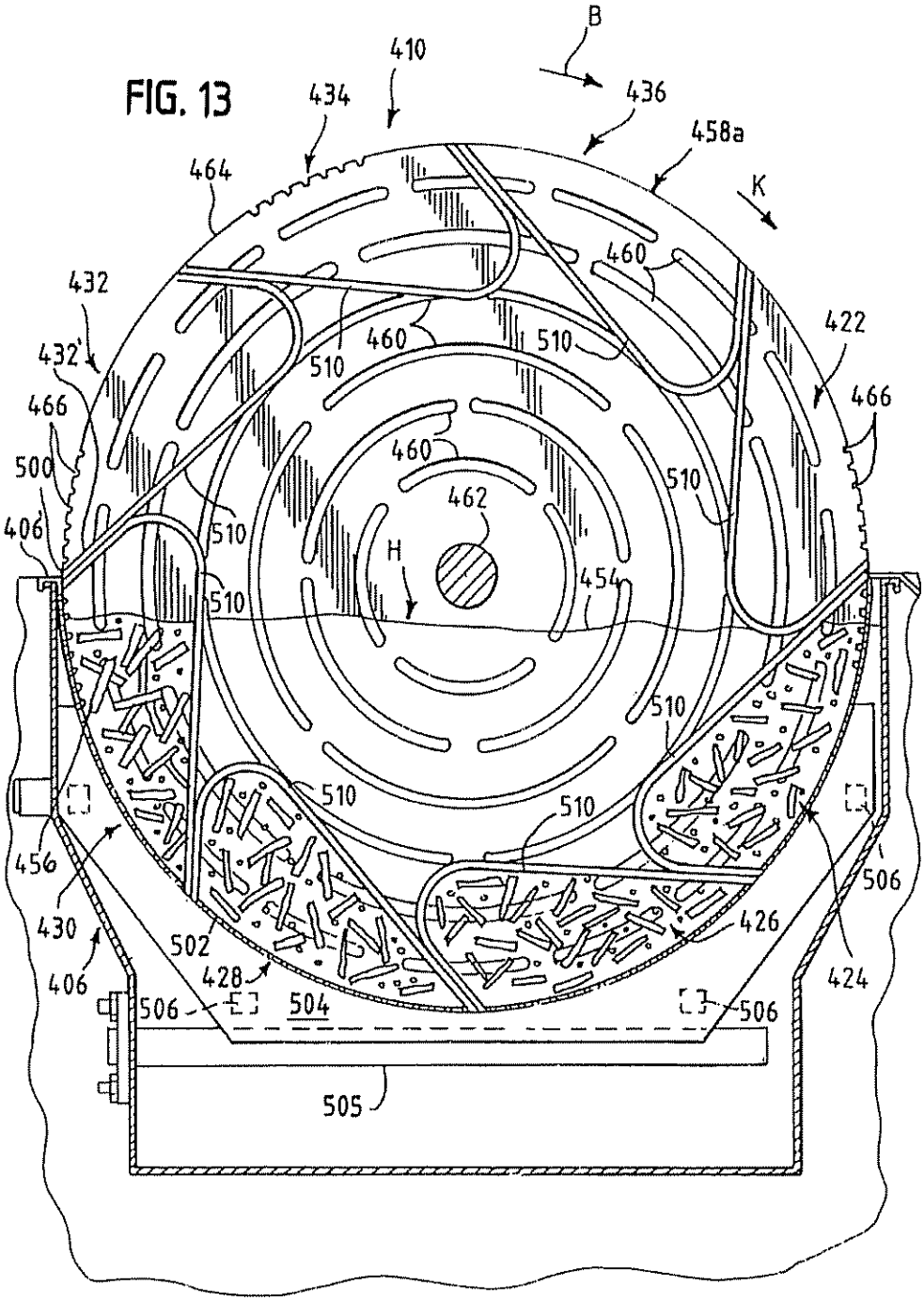

B
410
434
436
458a
K
464
460
432
422
432'
466
510
500
462
406
H
454
456
430
502
428
504
506
426
424
505

FIG. 14

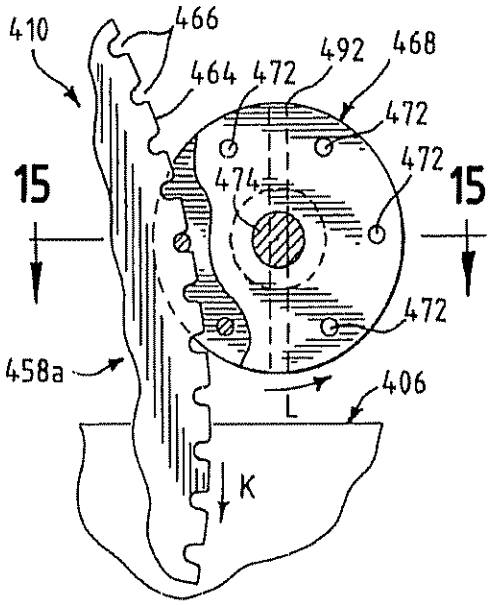


FIG. 15

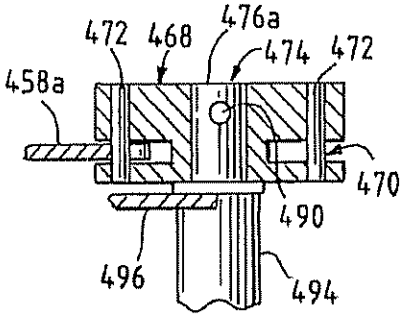


FIG. 16

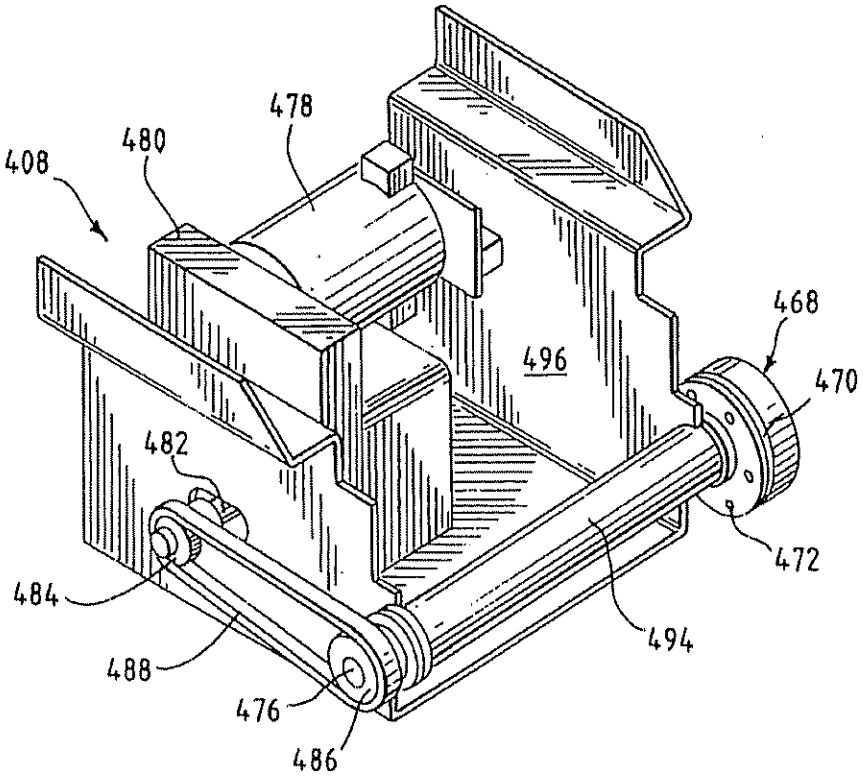


FIG. 17

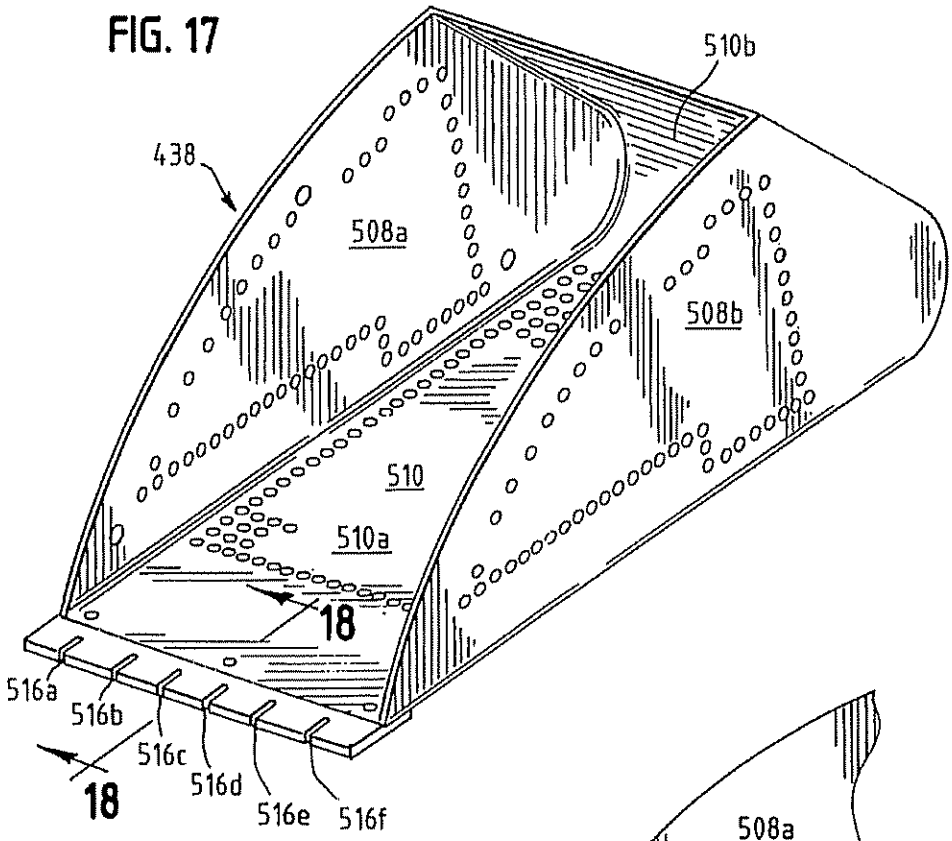


FIG. 18

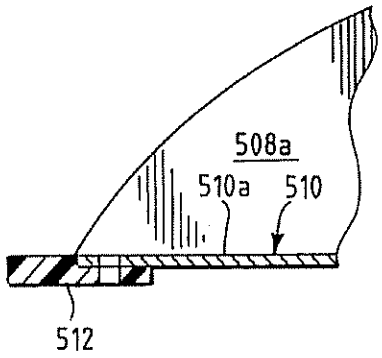


FIG. 19

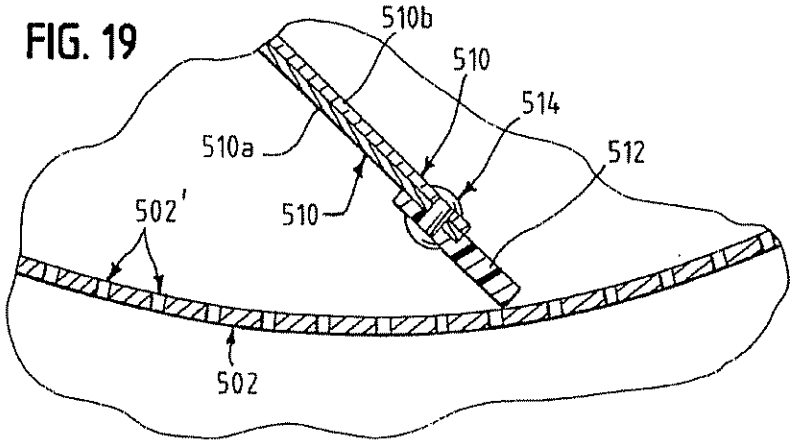


FIG. 20

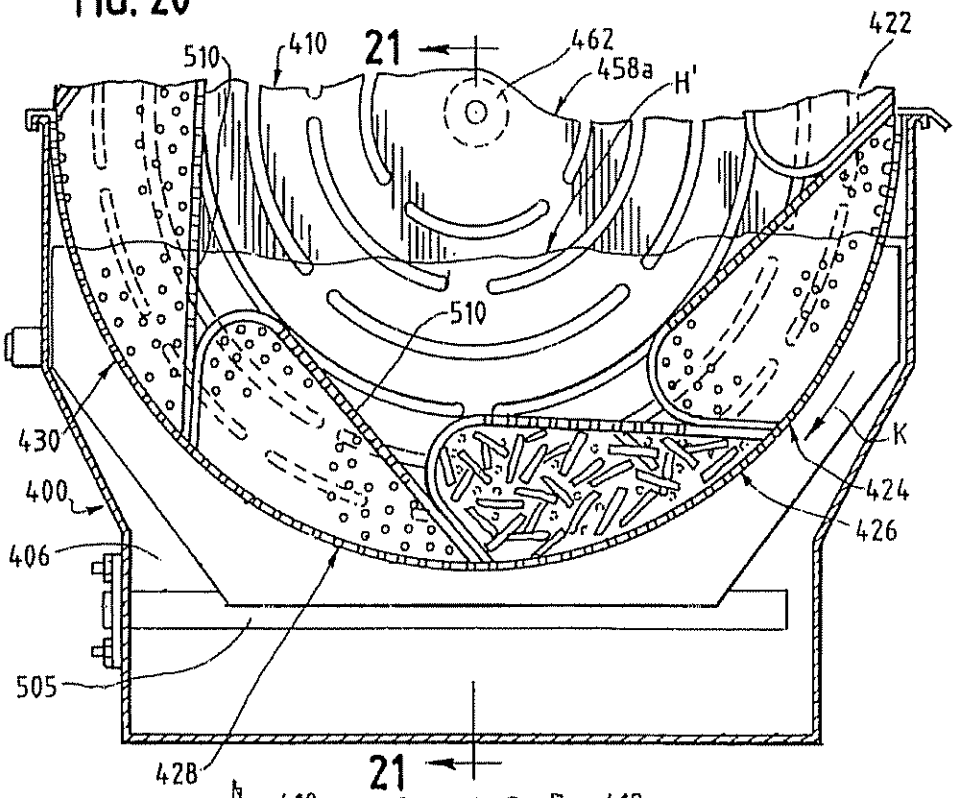


FIG. 21

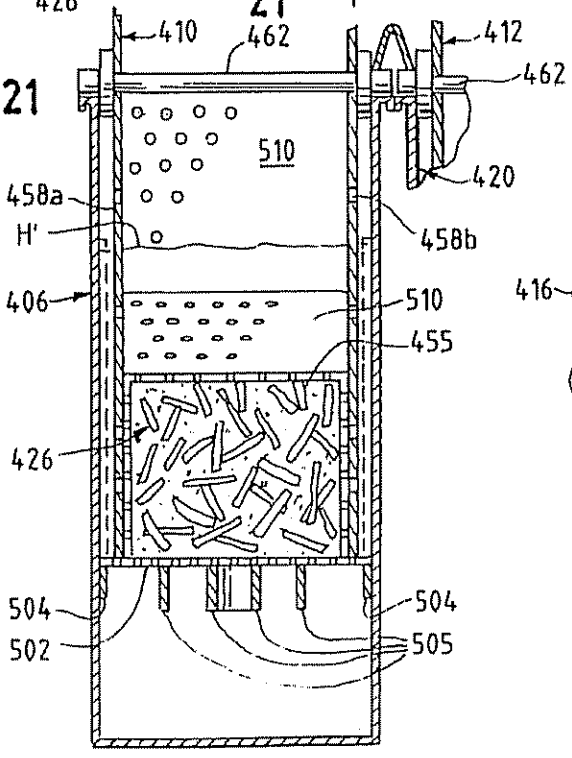


FIG. 22

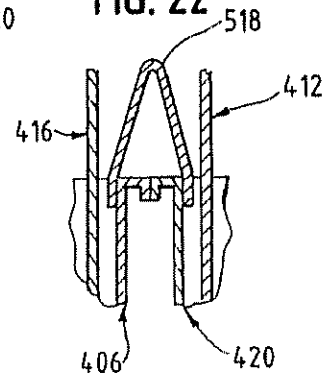


FIG. 23

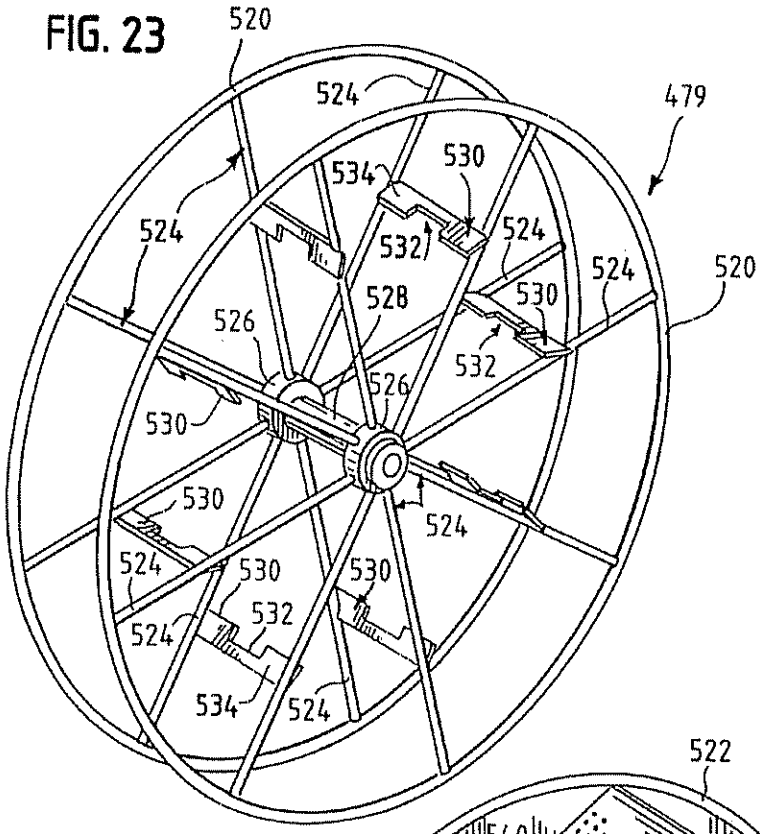

520
524
479
534
530
524
532
524
520
526
528
530
532
526
530
524
530
524
530
530
532
524
534
524

FIG. 24

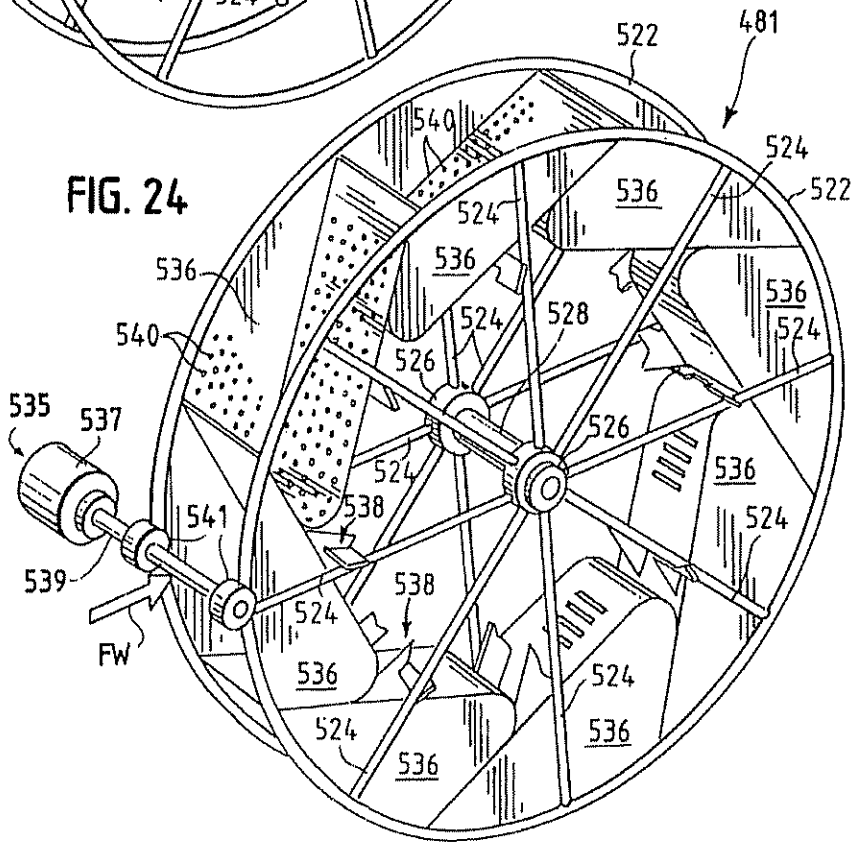

522
481
540
524
536
522
524
536
536
536
524
528
540
526
535
537
526
524
536
541
538
524
539
538
FW
524
536
524
536
524
536

FIG. 25

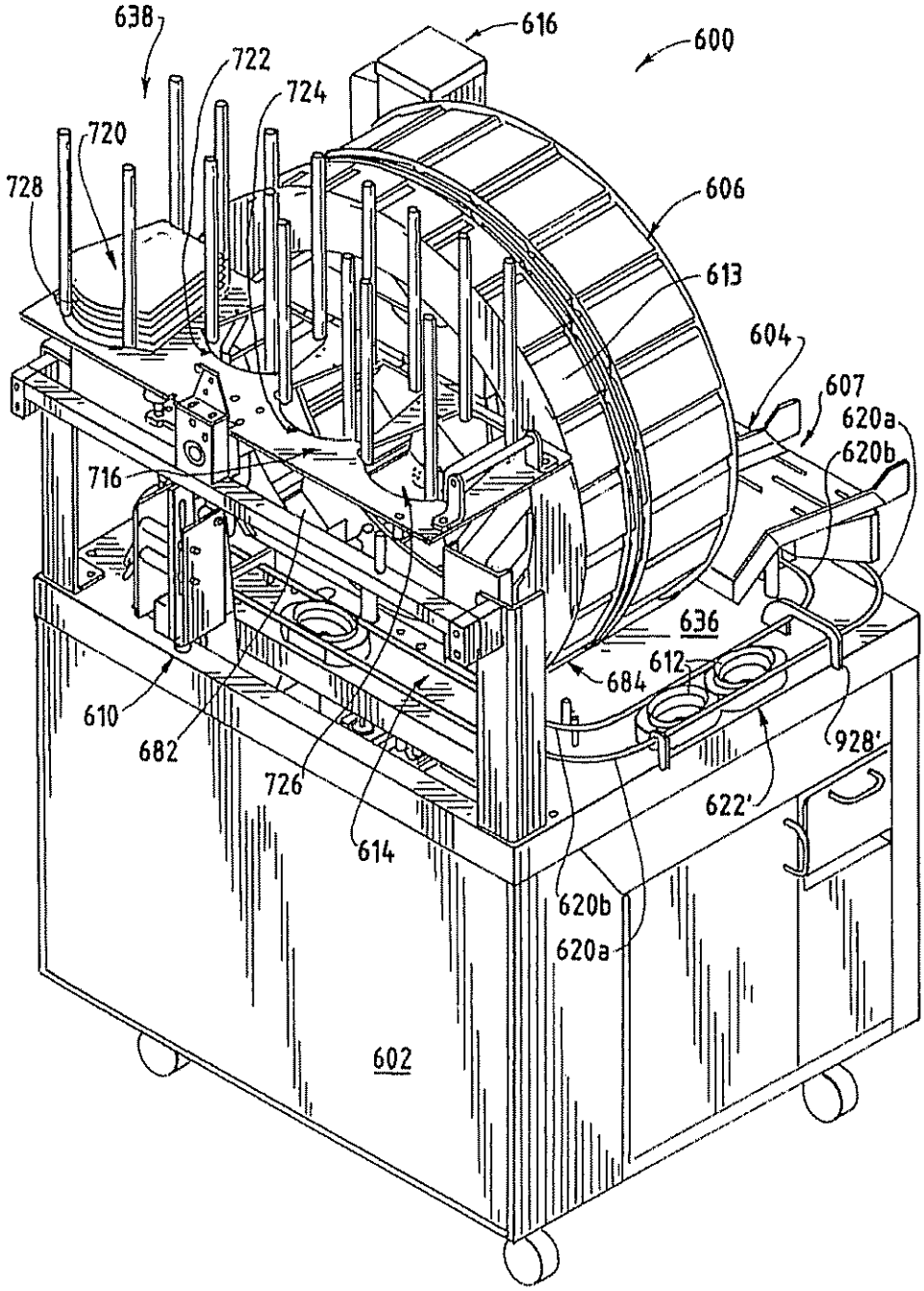

638
722
724
616
600
720
728
606
613
604
607
620a
620b
716
636
612
684
610
682
726
614
928'
622'
620b
620a
602

FIG. 26

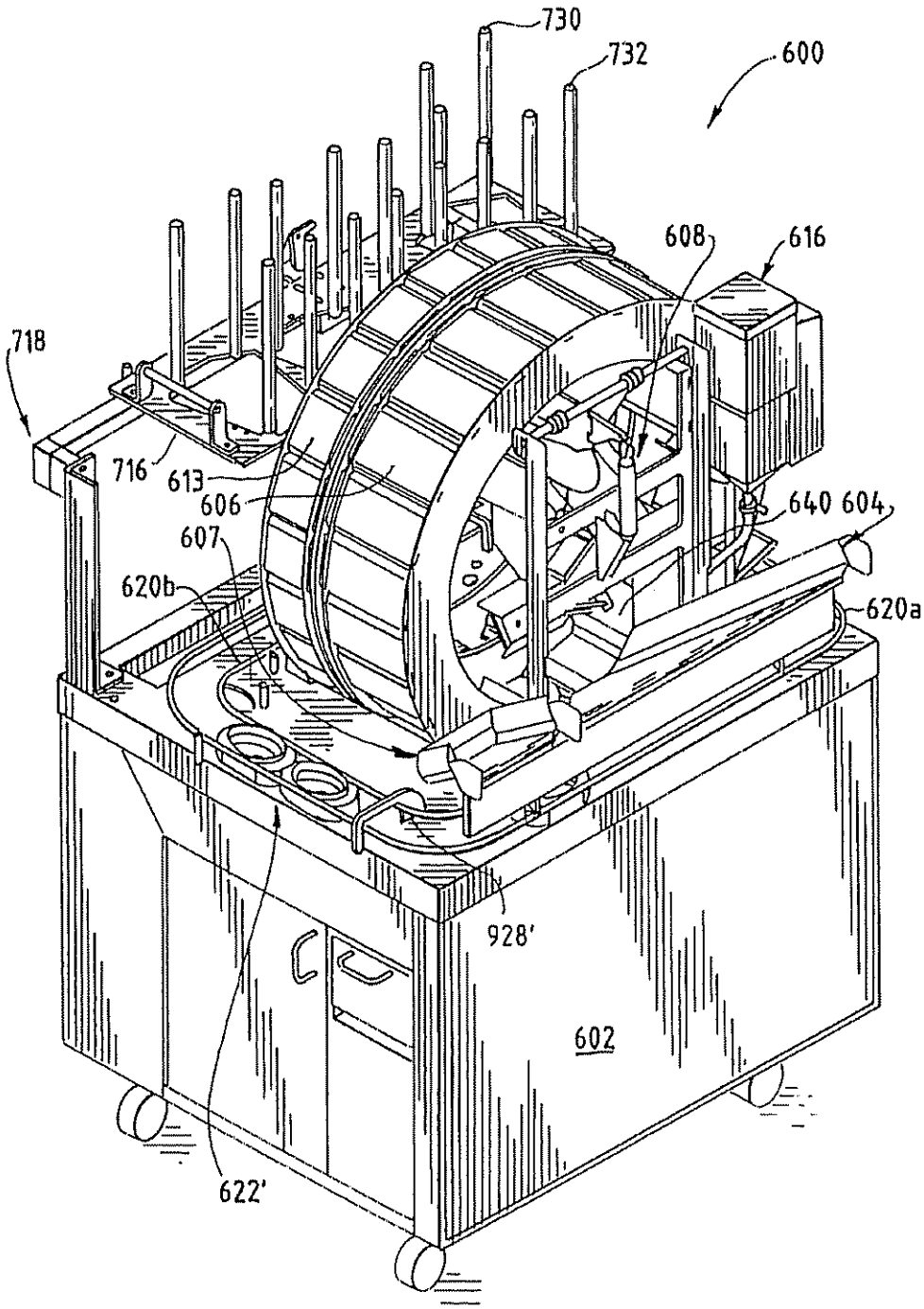

730
732
600
608
616
718
716
613
606
607
620b
640
604
620a
928'
602
622'

FIG. 27

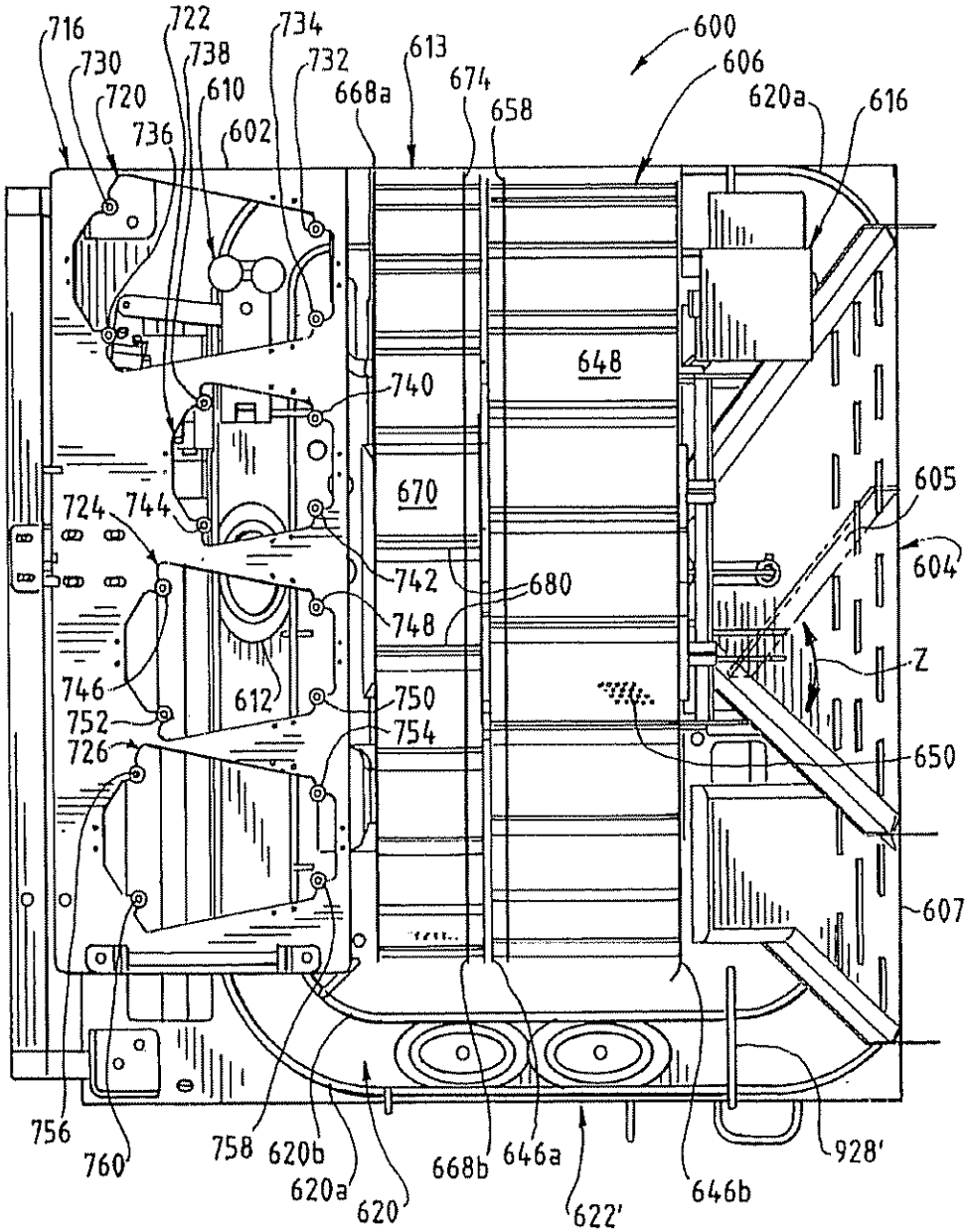

716
730
720
736
722
738
610
602
734
732
668a
613
674
658
600
606
620a
616
740
648
670
605
604
724
744
742
680
748
Z
746
612
750
752
754
726
650
607
756
760
758
620b
620a
620
668b
646a
622'
646b
928'

FIG. 28

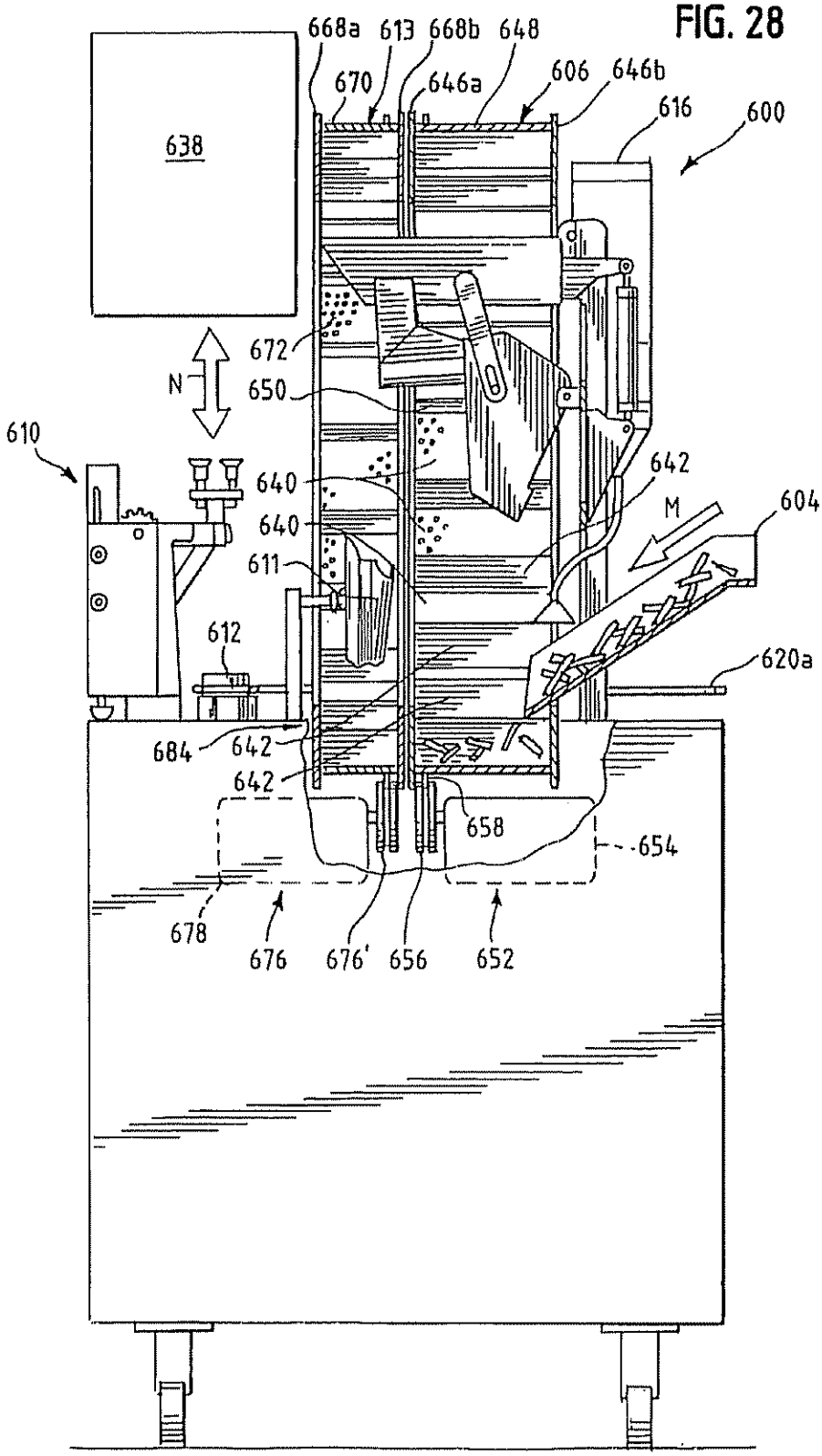

668a
613
668b
648
670
646a
606
646b
616
600
638
672
N
650
610
642
640
M
604
640
611
612
620a
684
642
642
658
654
678
676
676'
656
652

FIG. 29

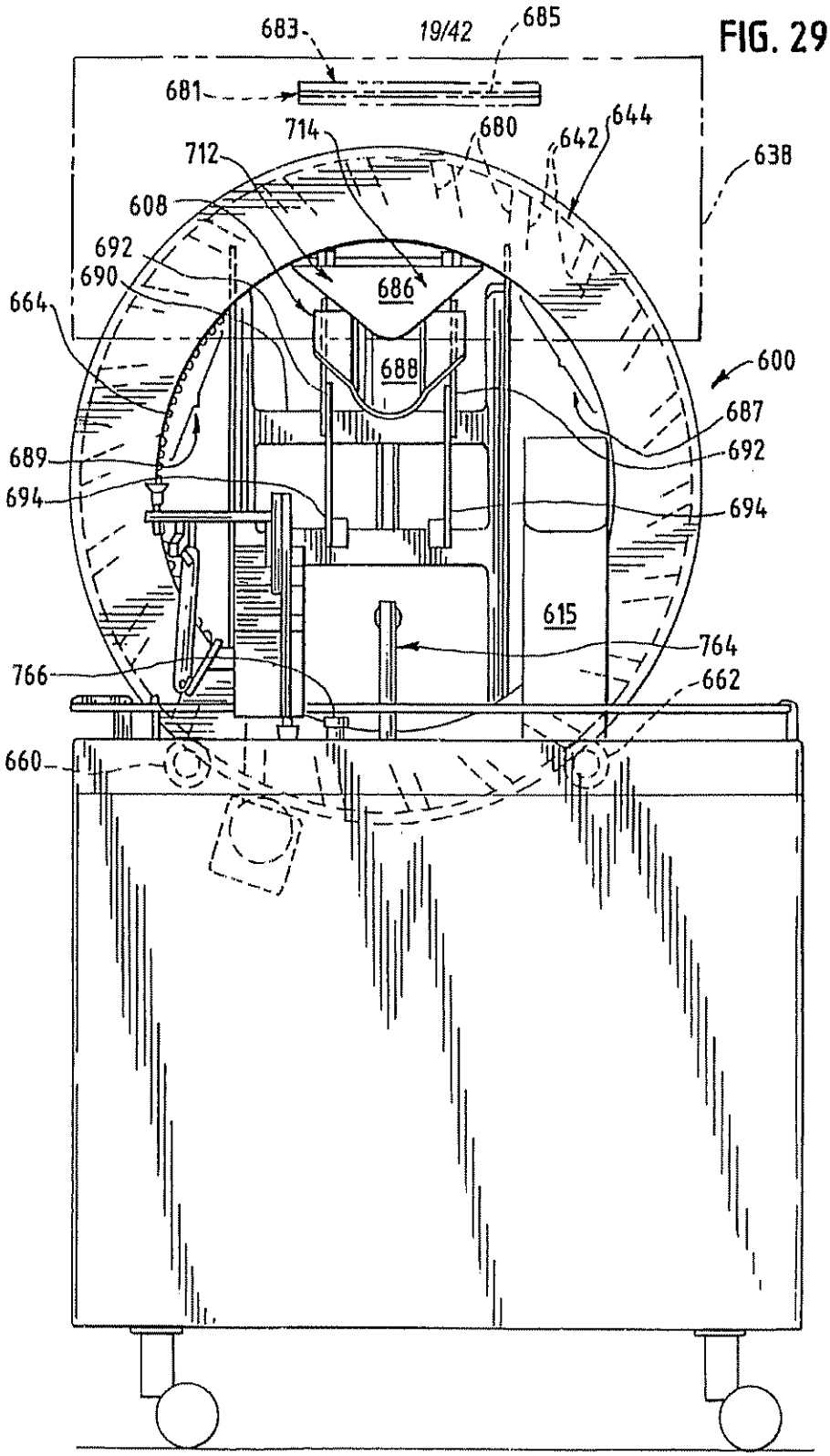

19/42
683
685
681
714
680
642
644
712
638
608
692
690
686
664
600
688
687
689
692
694
694
615
764
766
662
660

FIG. 30

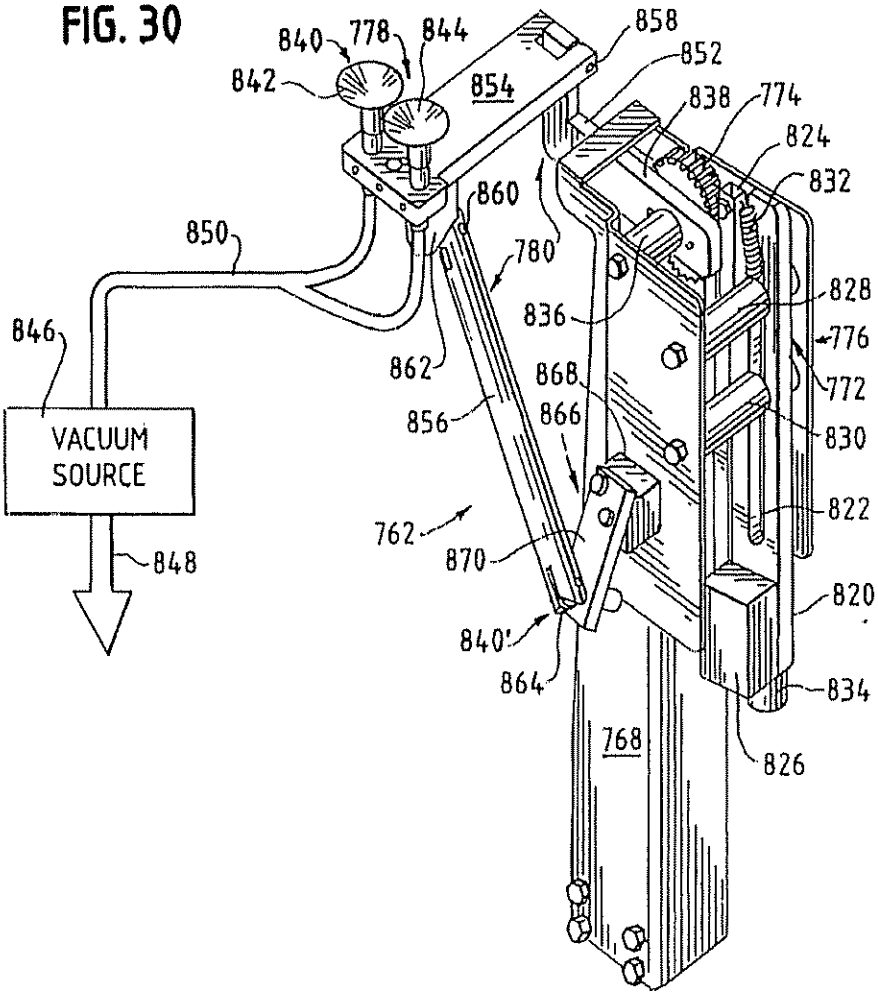

840
778
844
842
854
858
852
838
774
824
832
860
850
780
828
836
776
846
862
868
772
856
866
830
VACUUM SOURCE
762
822
870
848
820
840'
864
834
768
826

FIG. 31

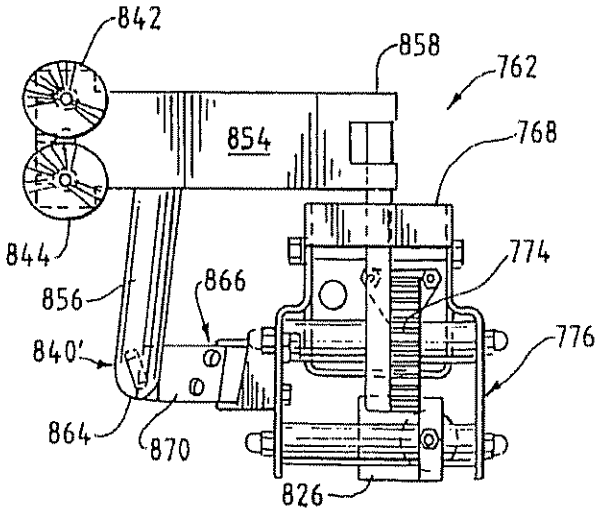

842
858
762
854
768
844
774
866
856
776
840'
864
870
826

FIG. 32

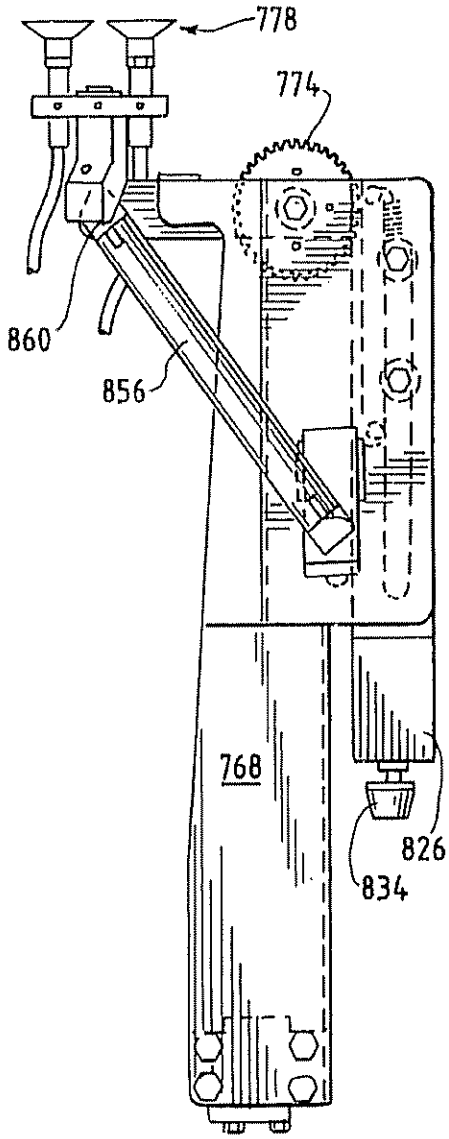

778
774
860
856
768
826
834

FIG. 33

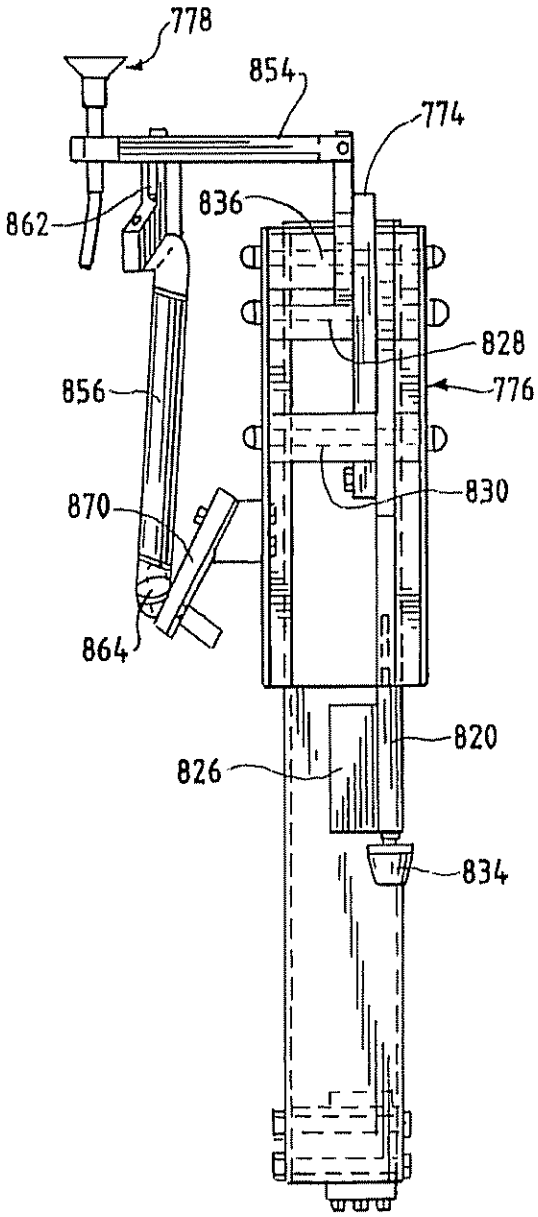

778
854
774
862
836
828
856
776
870
830
864
820
826
834

FIG. 34

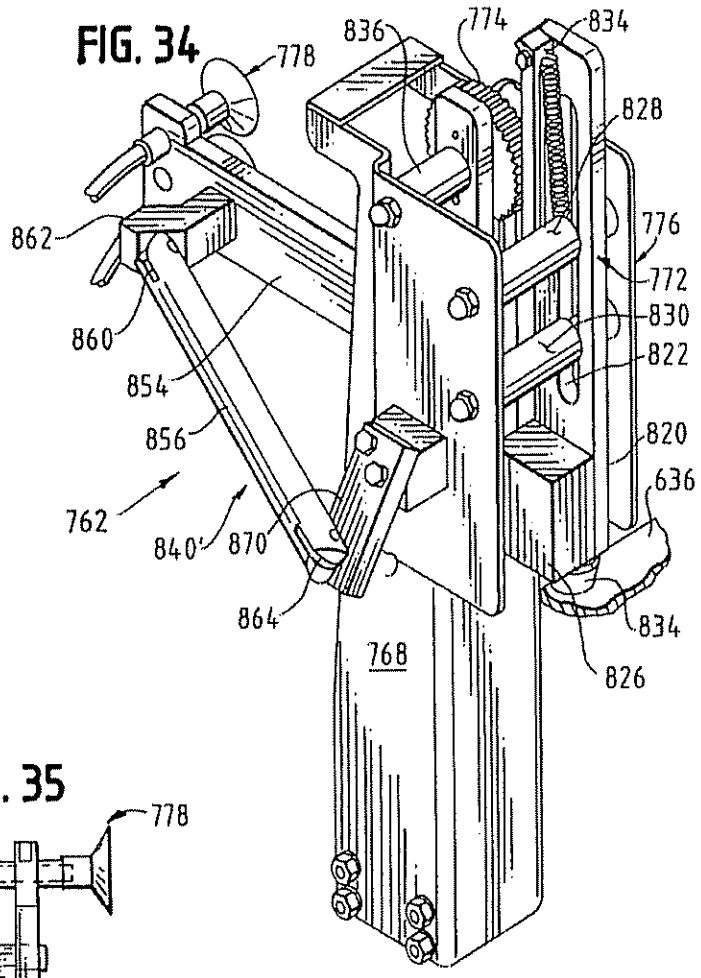

778
836
774
834
828
862
776
772
860
830
854
822
856
820
636
762
840
870
864
834
768
826

FIG. 35

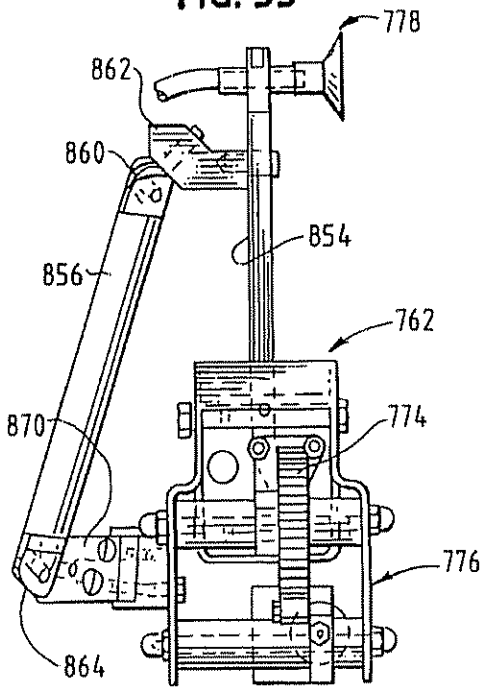

778
862
860
854
856
762
870
774
776
864

FIG. 36

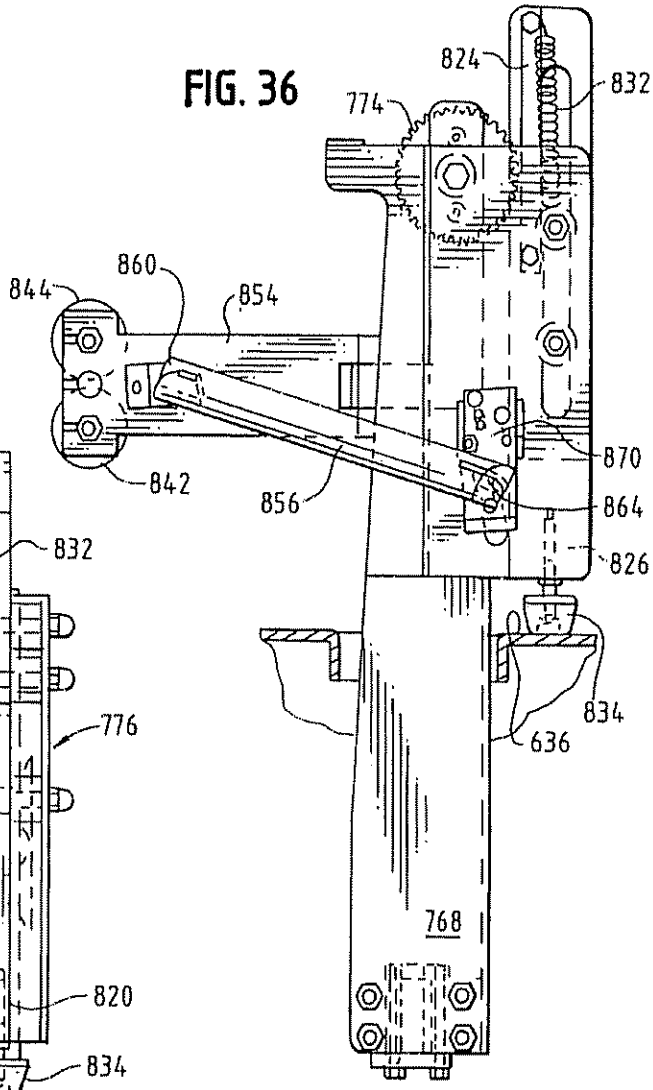

824
832
774
860
844
854
870
842
856
864
826
834
636
768

FIG. 37

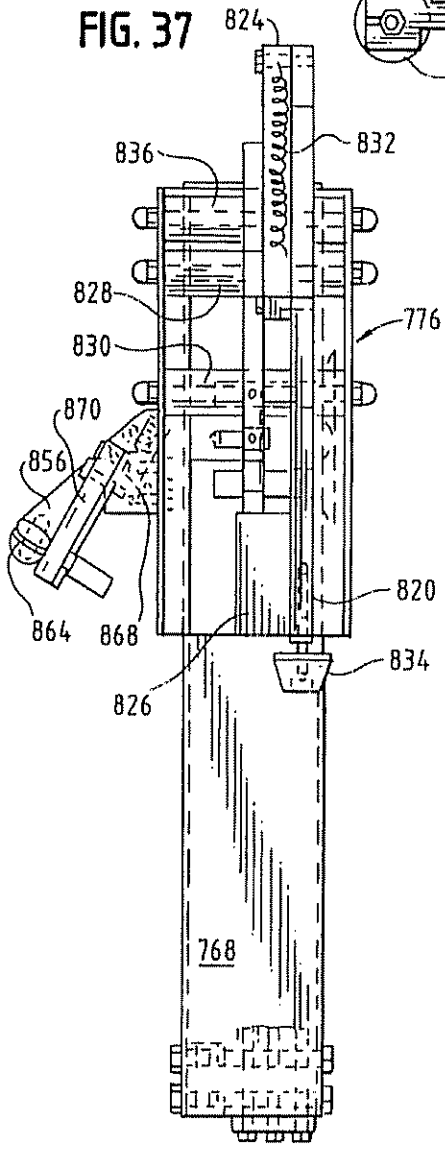
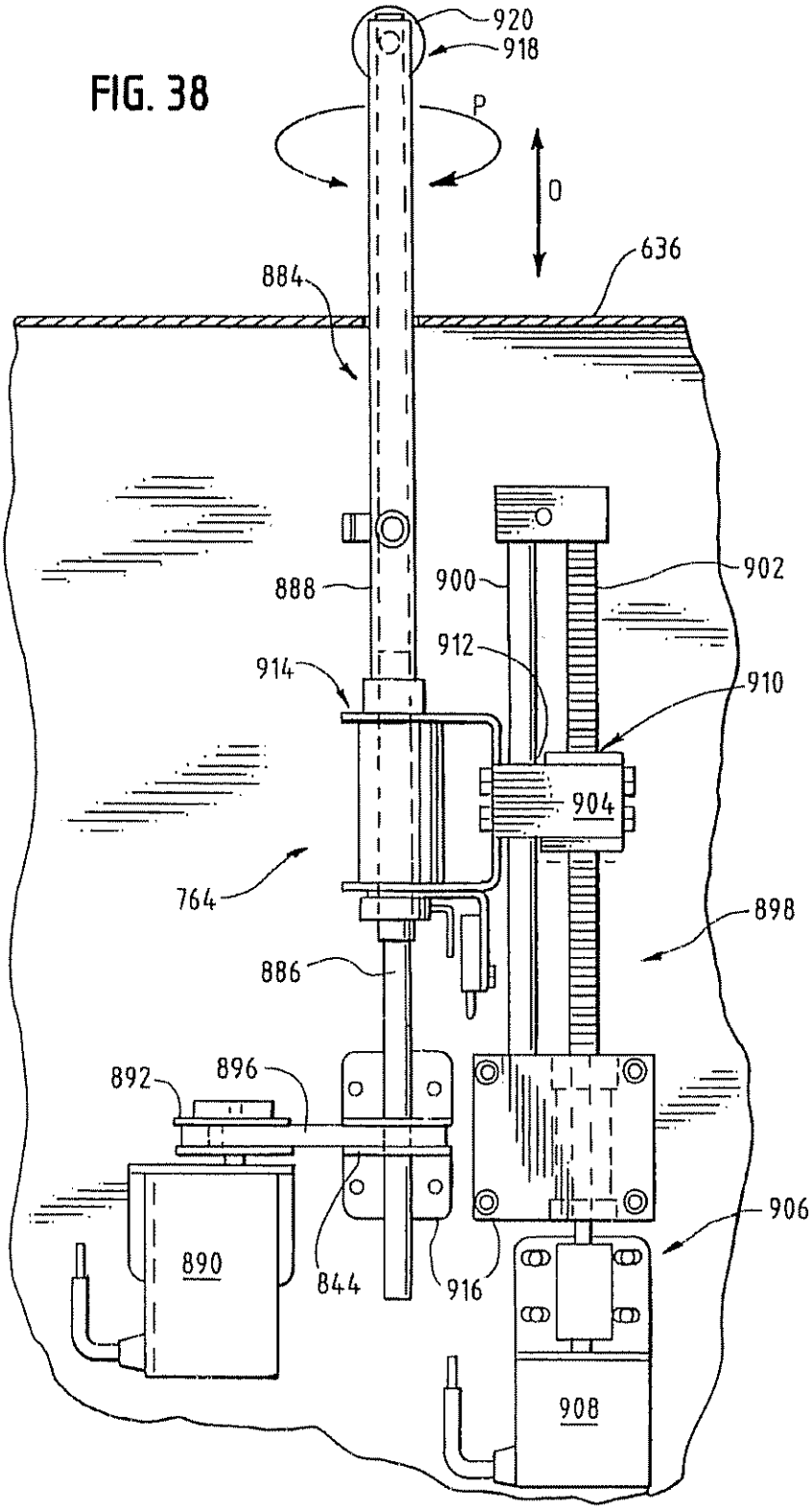

824
836
832
828
776
830
870
856
820
864
868
834
826
768

FIG. 38


920
918
P
O
636
884
888
900
902
912
914
910
904
764
898
886
892
896
890
844
916
906
908

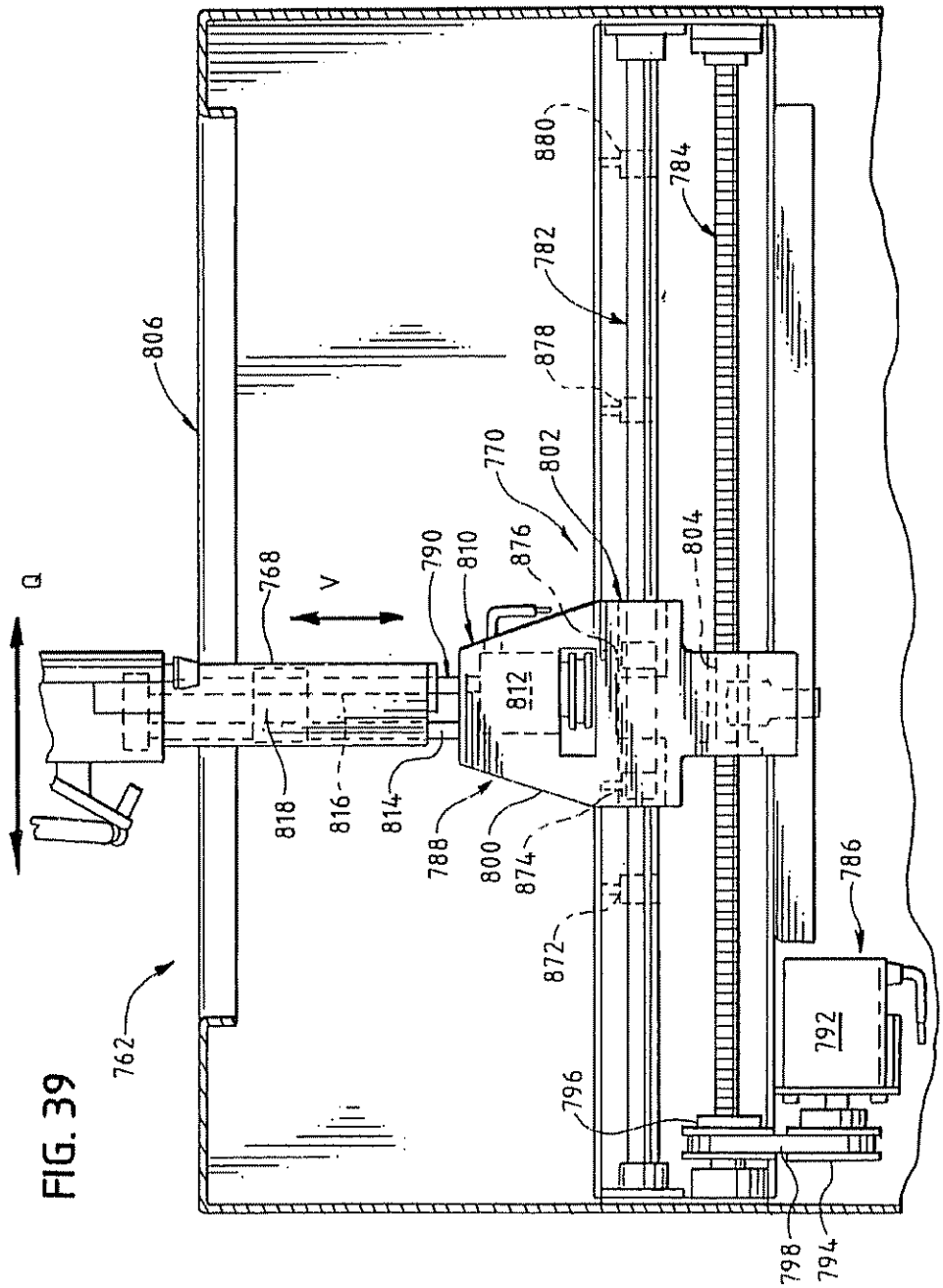

880
784
782
878
806
770
802
804
790
810
876
768
Q
V
812
818
816
814
788
800
874
786
872
792
762
796
798
794

FIG. 39

FIG. 40

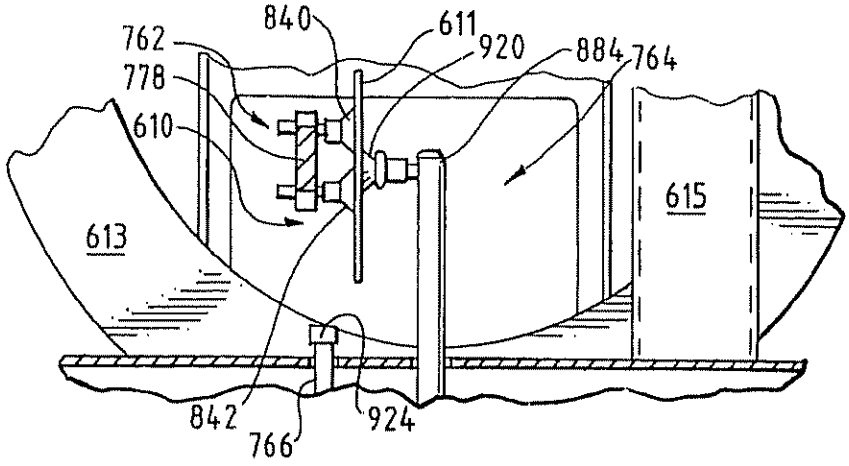


FIG. 41

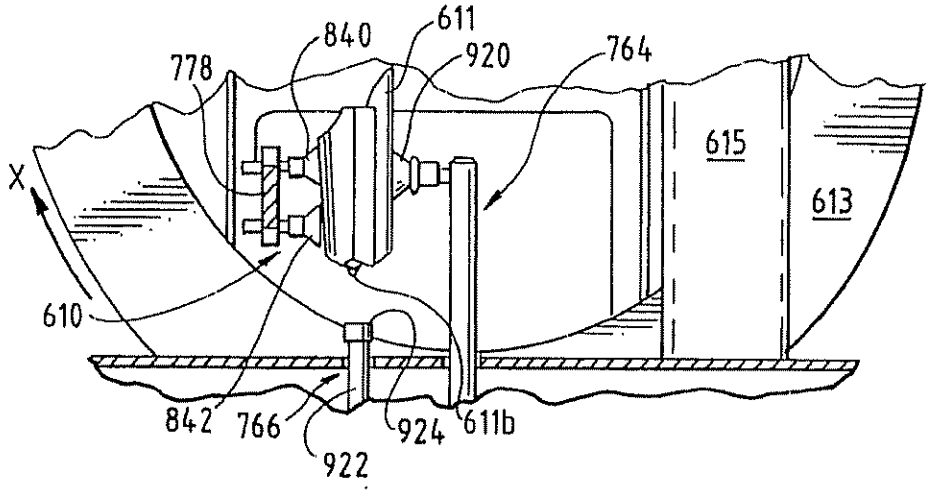


FIG. 42

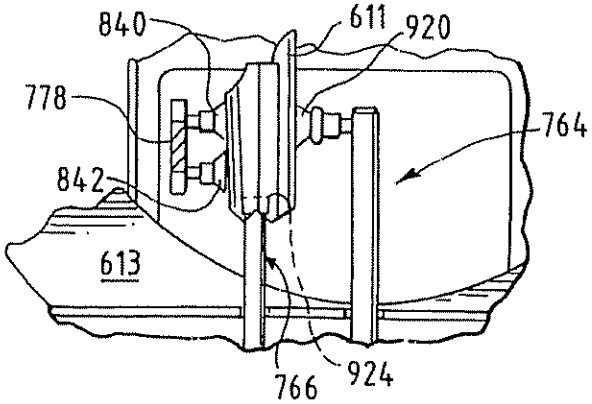


FIG. 43

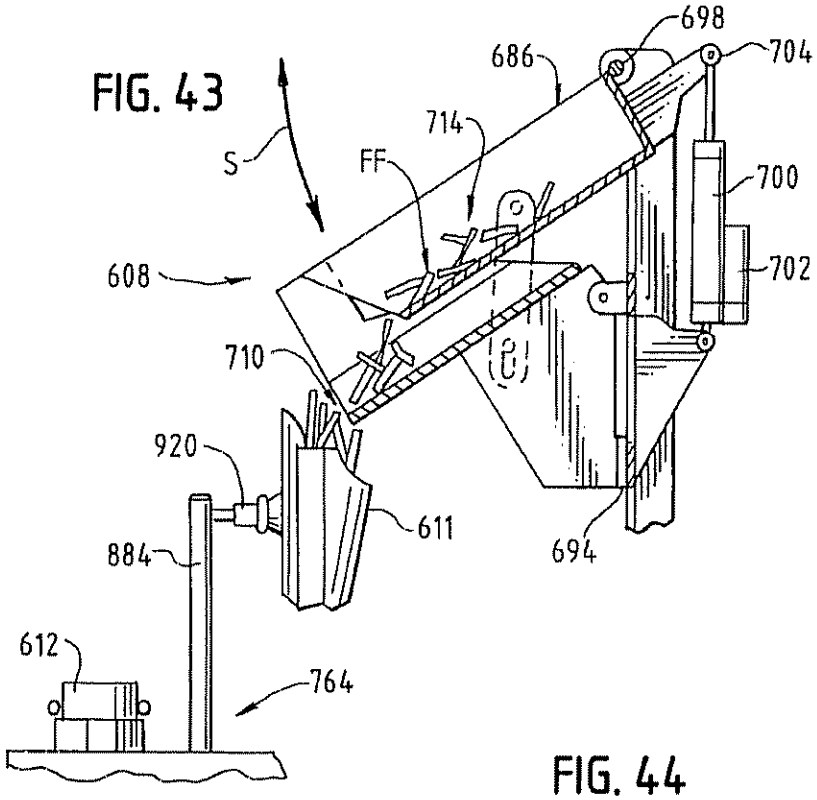

698
686
704
714
S
FF
700
608
702
710
920
611
884
694
612
764

FIG. 44

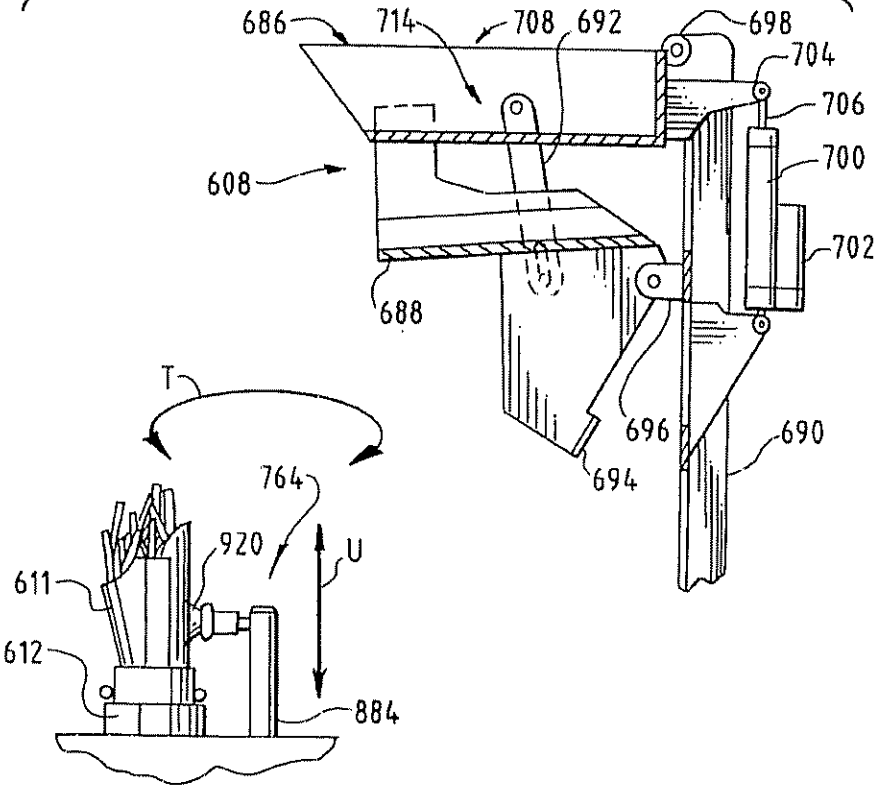

686
714
708
692
698
704
706
700
608
702
688
T
696
690
694
764
920
U
611
612
884

FIG. 45

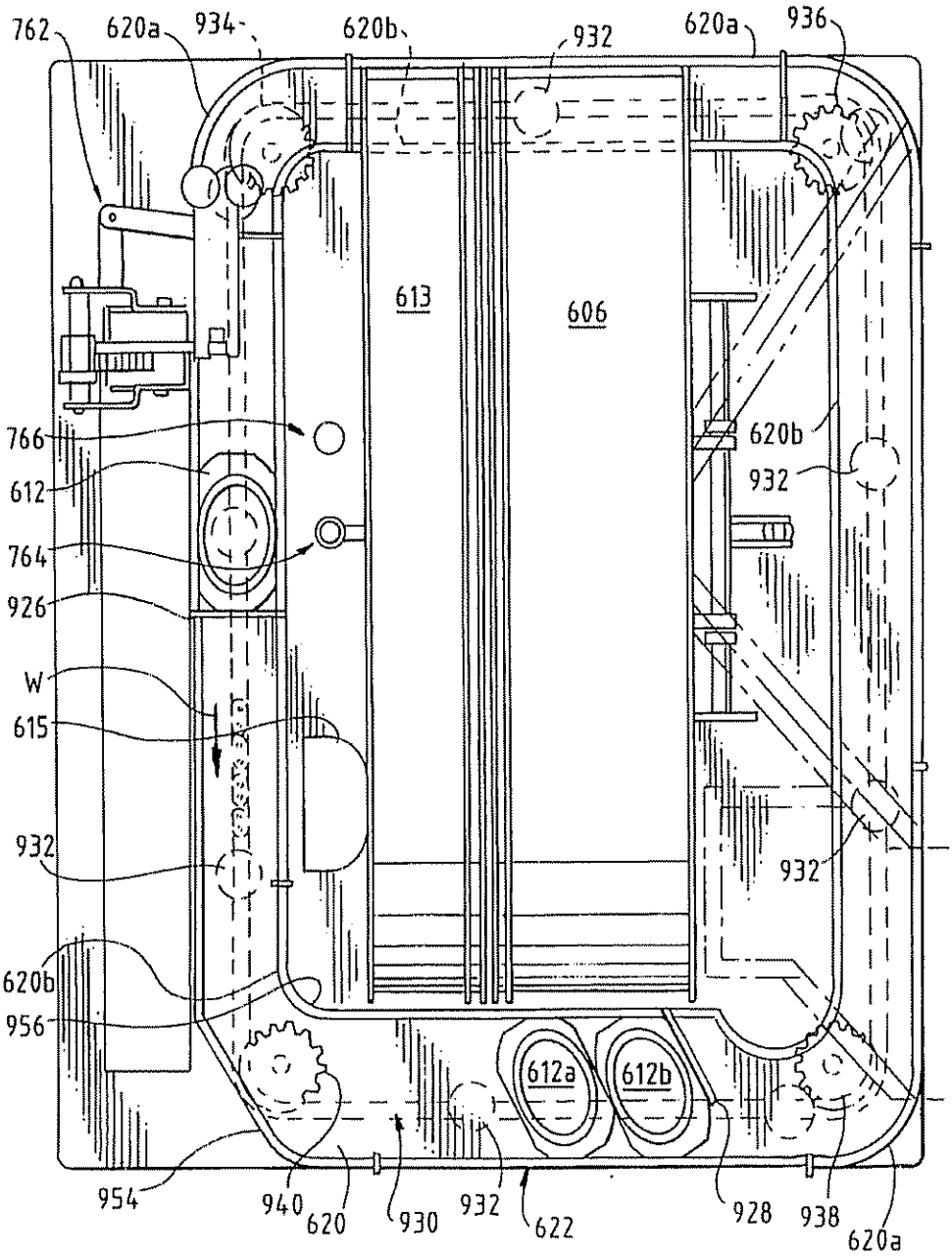

762
620a
934
620b
932
620a
936
613
606
766
612
764
926
W
615
932
620b
956
954
940
620
930
932
622
612a
612b
928
938
620a
620b
932
932

FIG. 46

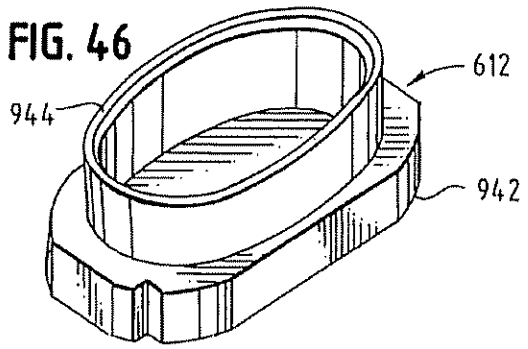


FIG. 47

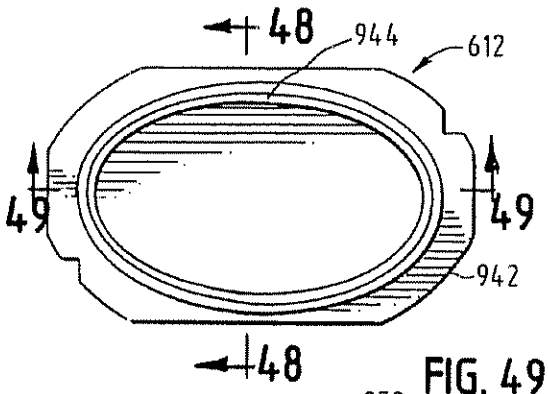


FIG. 48

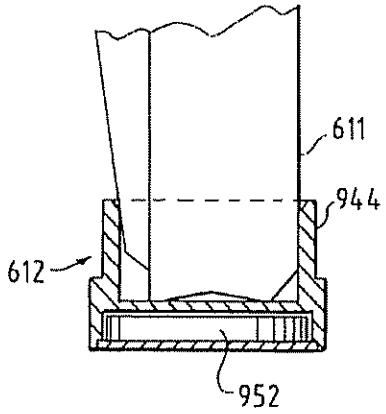


FIG. 49

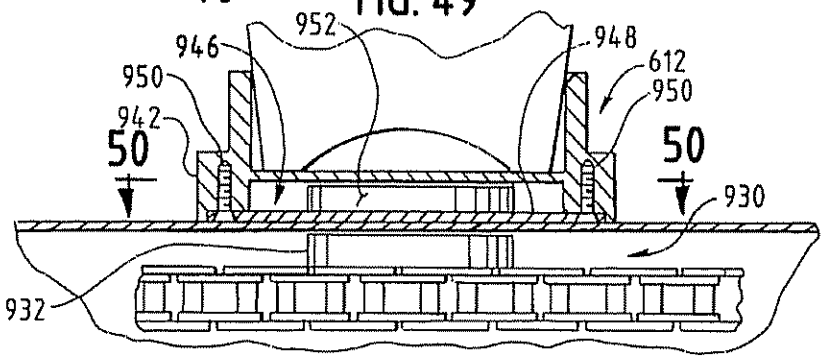


FIG. 50

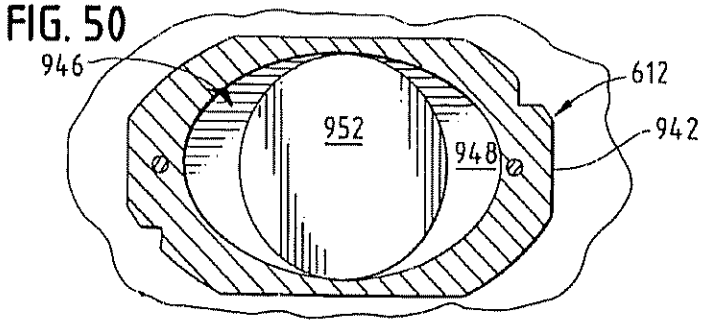


FIG. 51

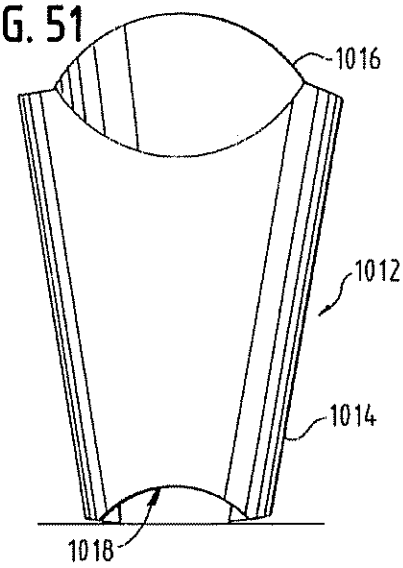


FIG. 52

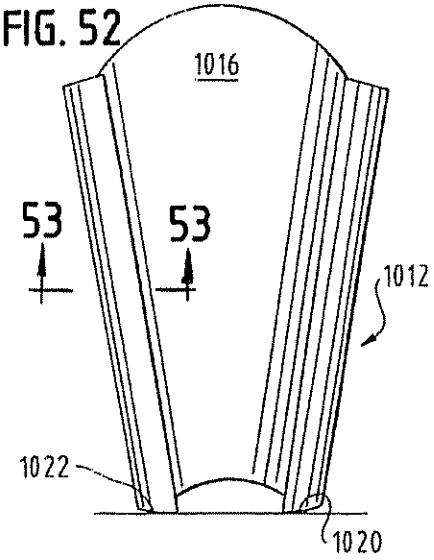


FIG. 53

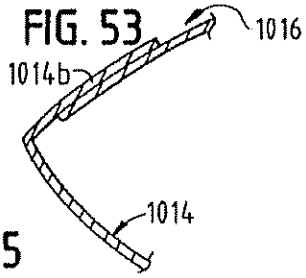


FIG. 54

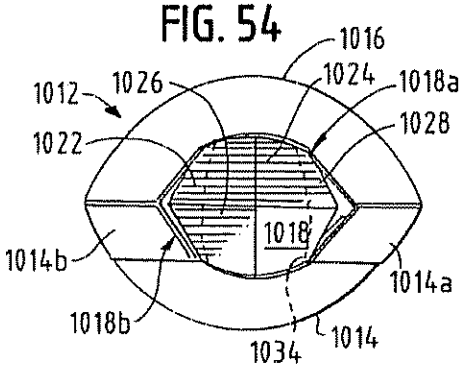


FIG. 55

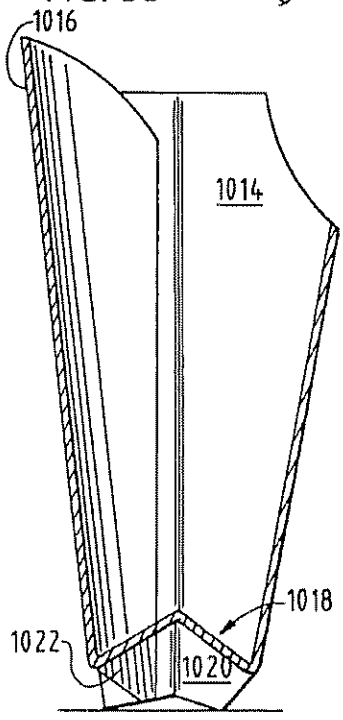


FIG. 56

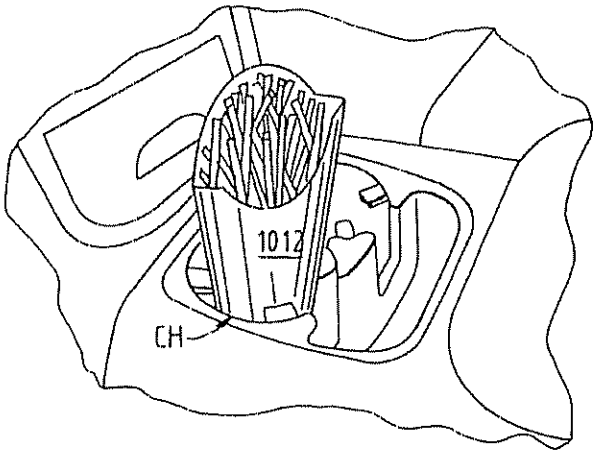


FIG. 57

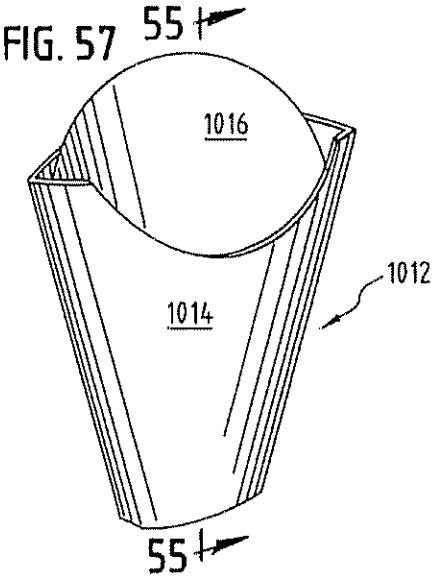


FIG. 58

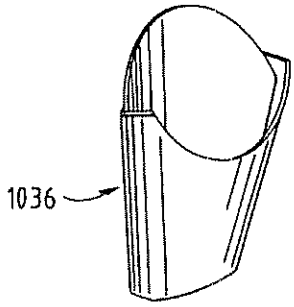


FIG. 59

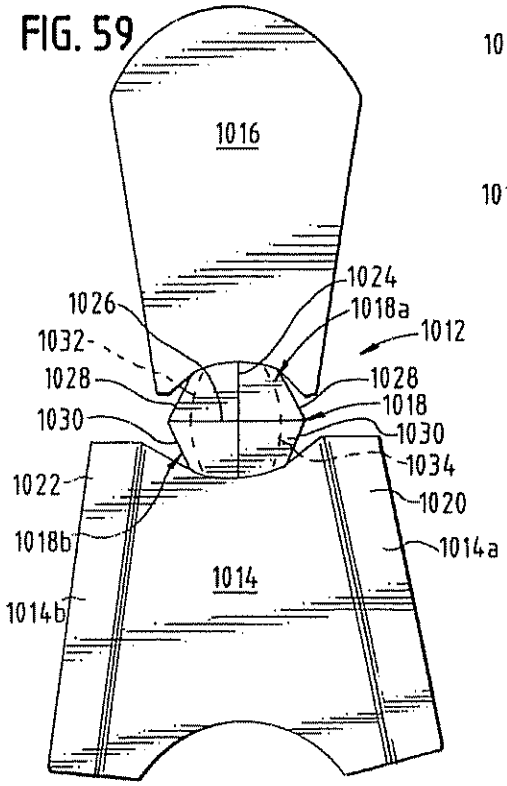


FIG. 60

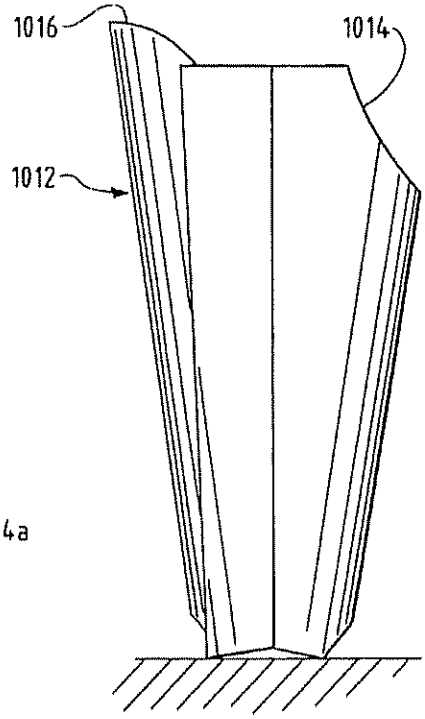


FIG. 61

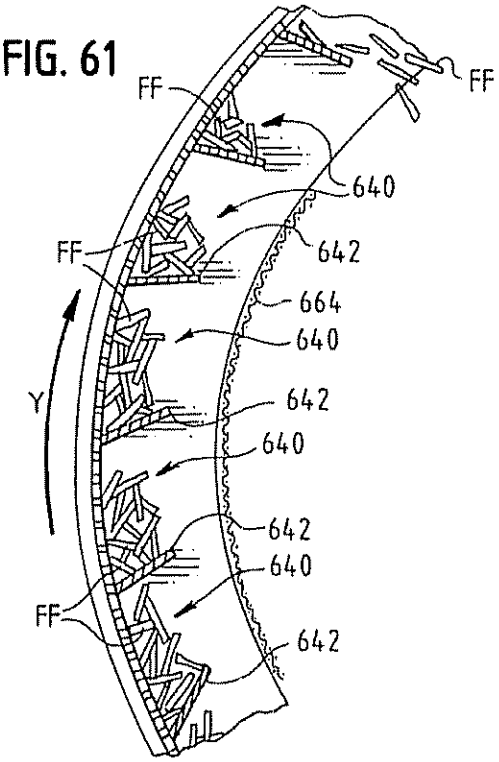


FIG. 62

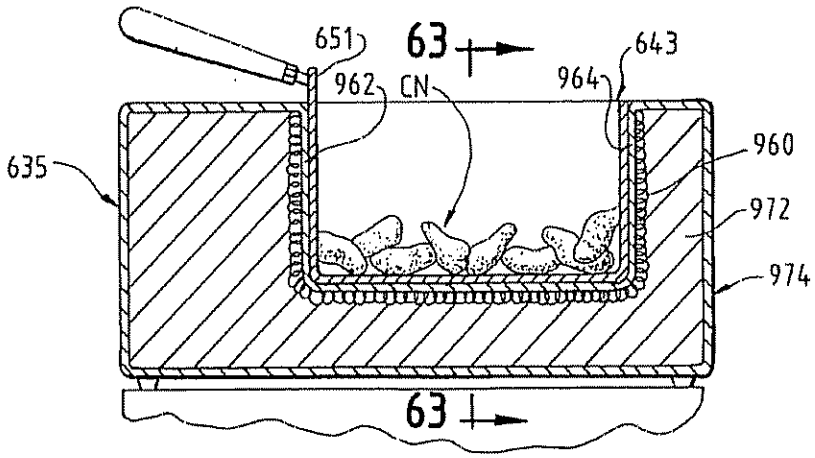


FIG. 63

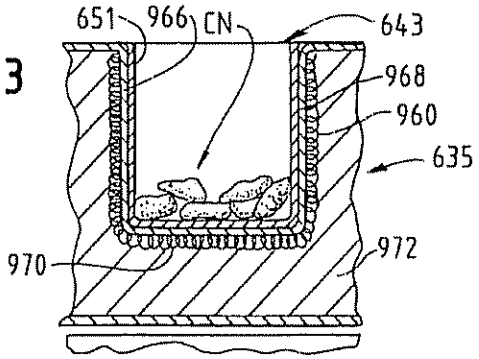


FIG. 64

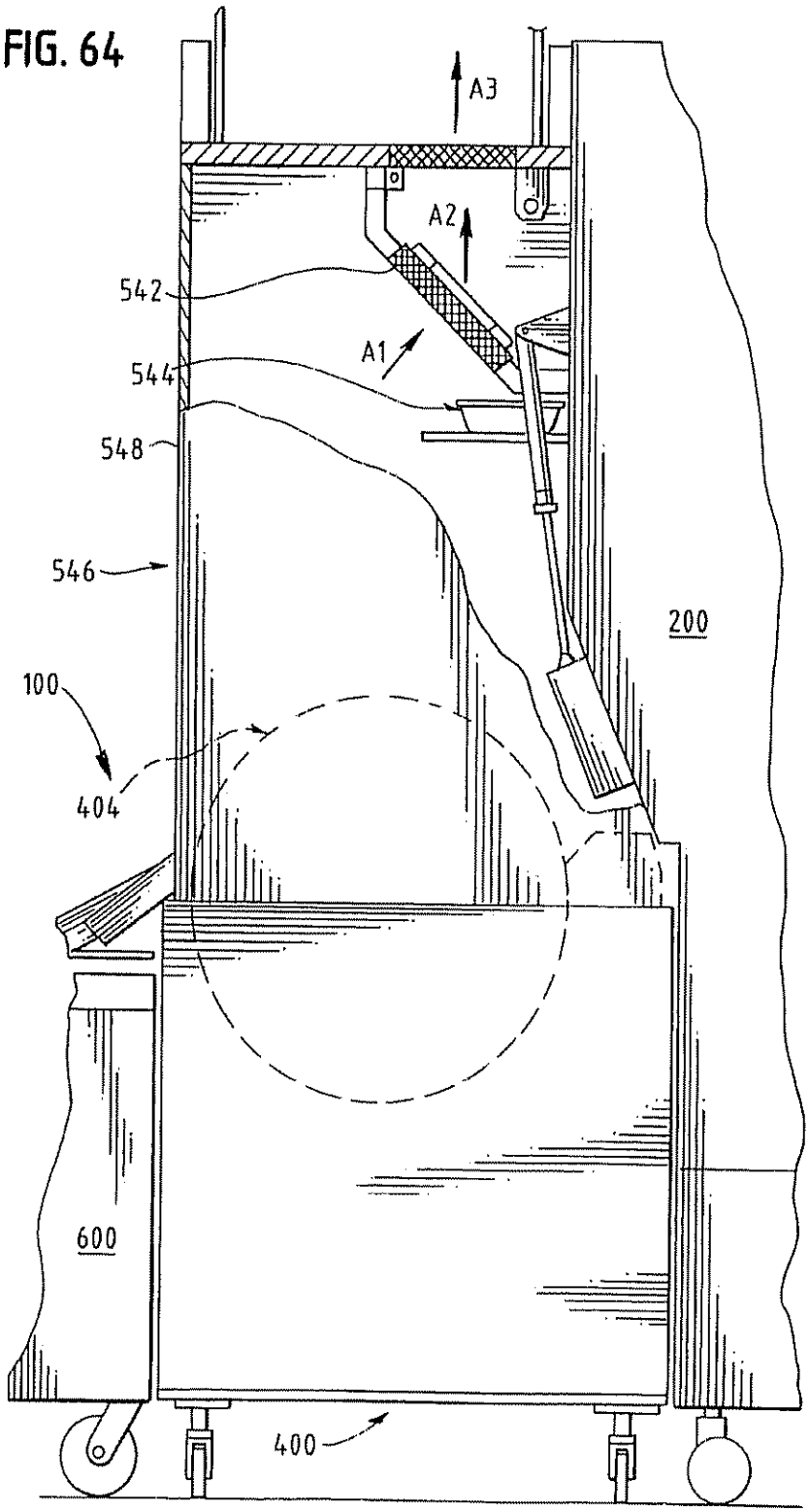


FIG. 65

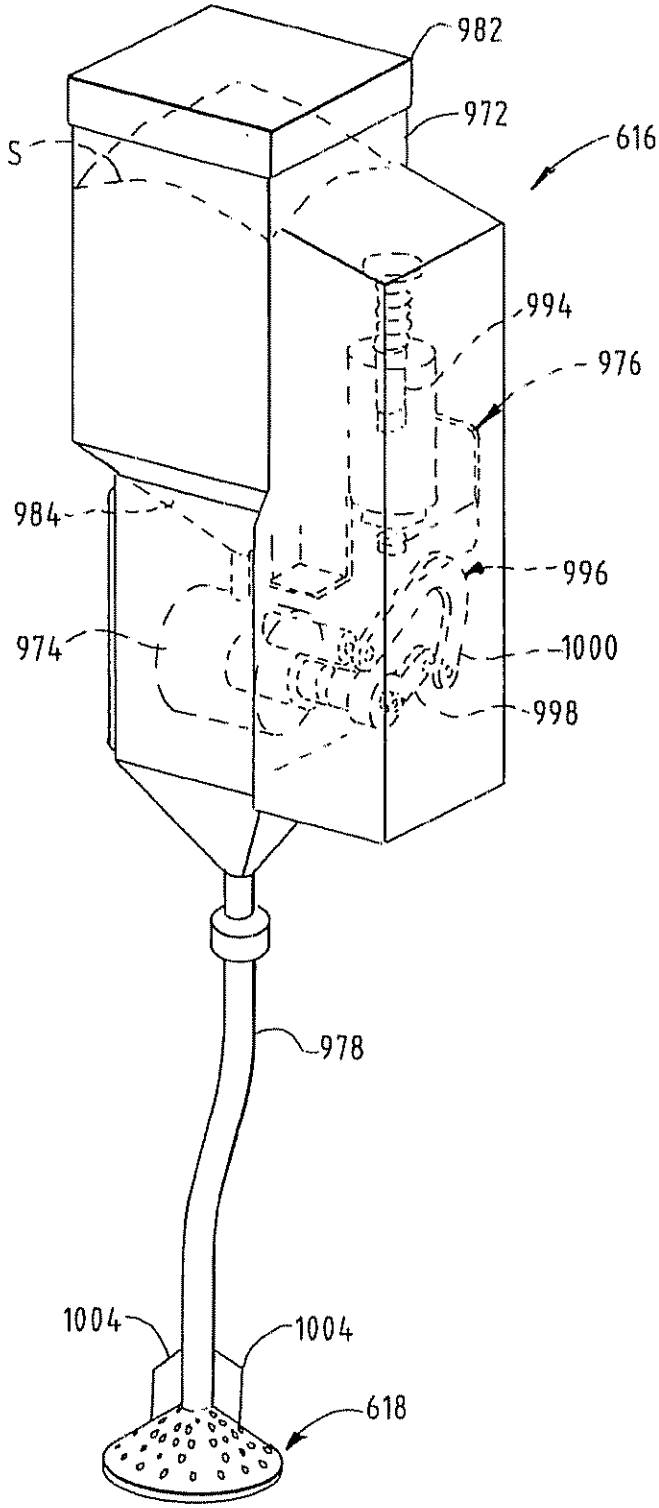


FIG. 66

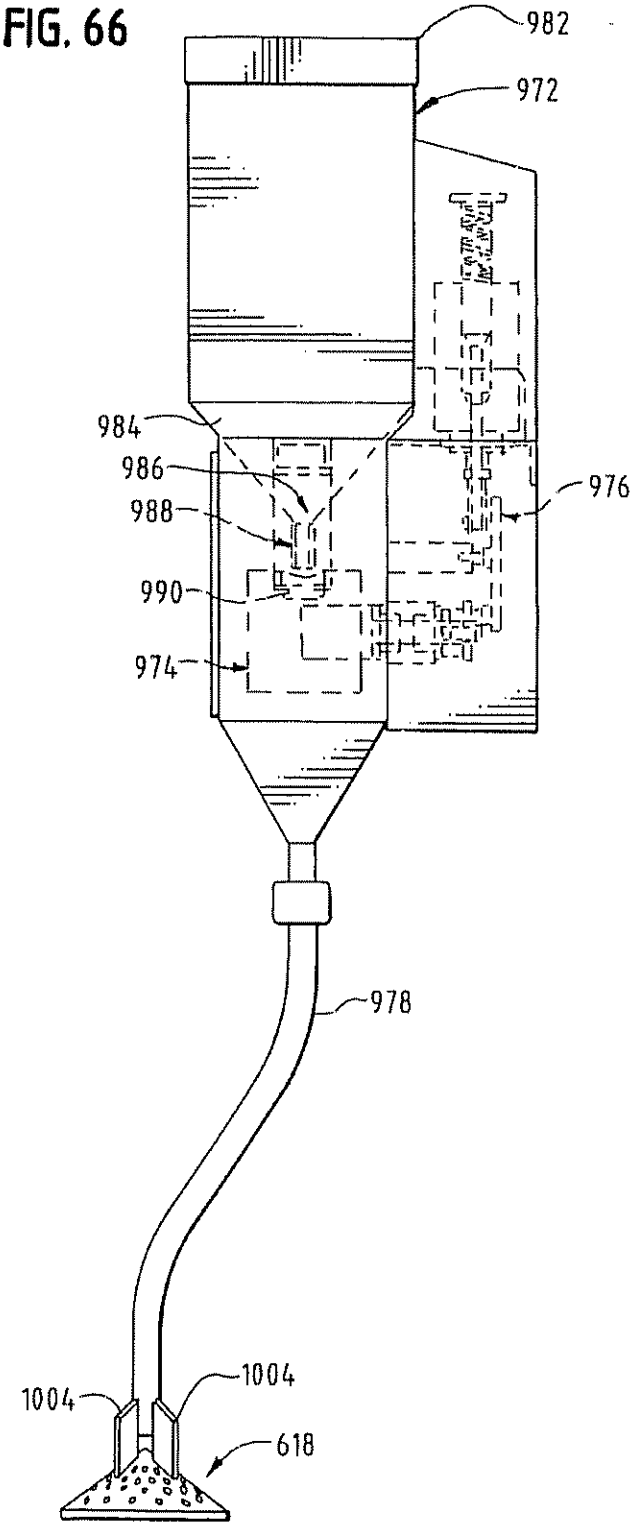


FIG. 67

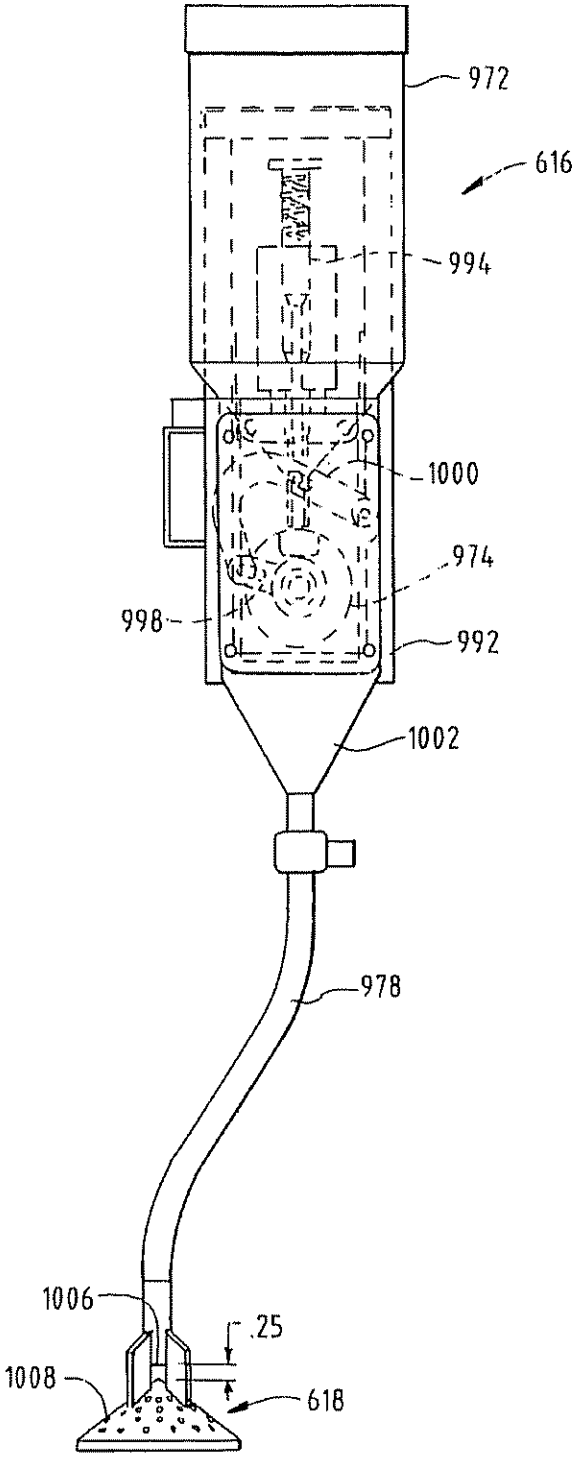


FIG. 68

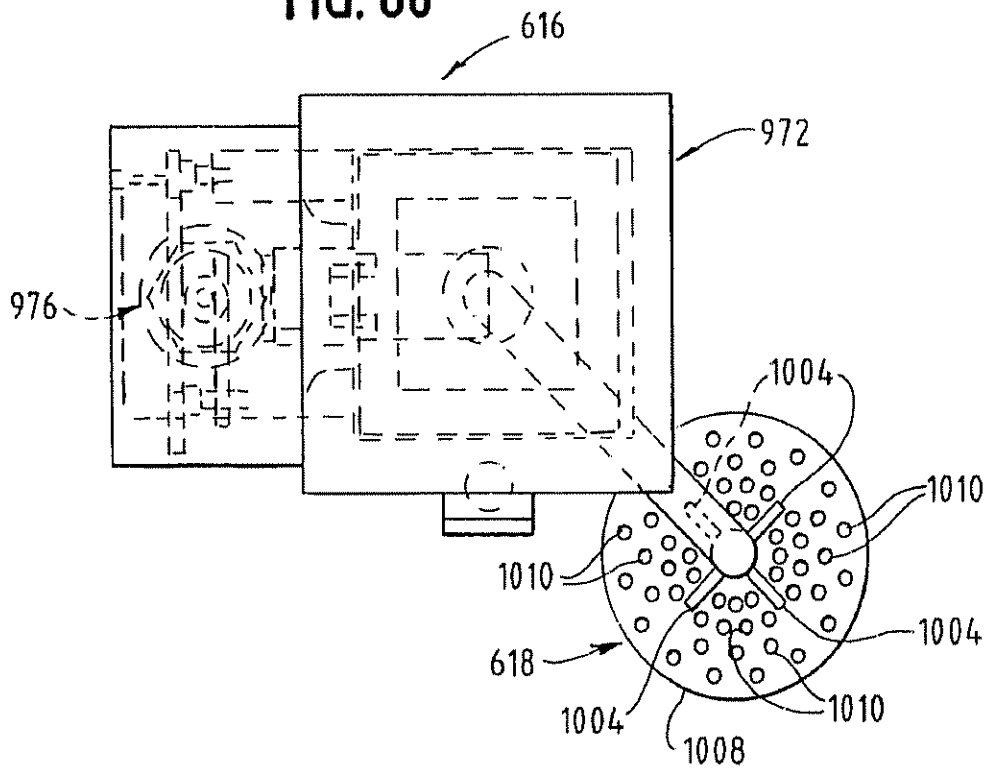


FIG. 69

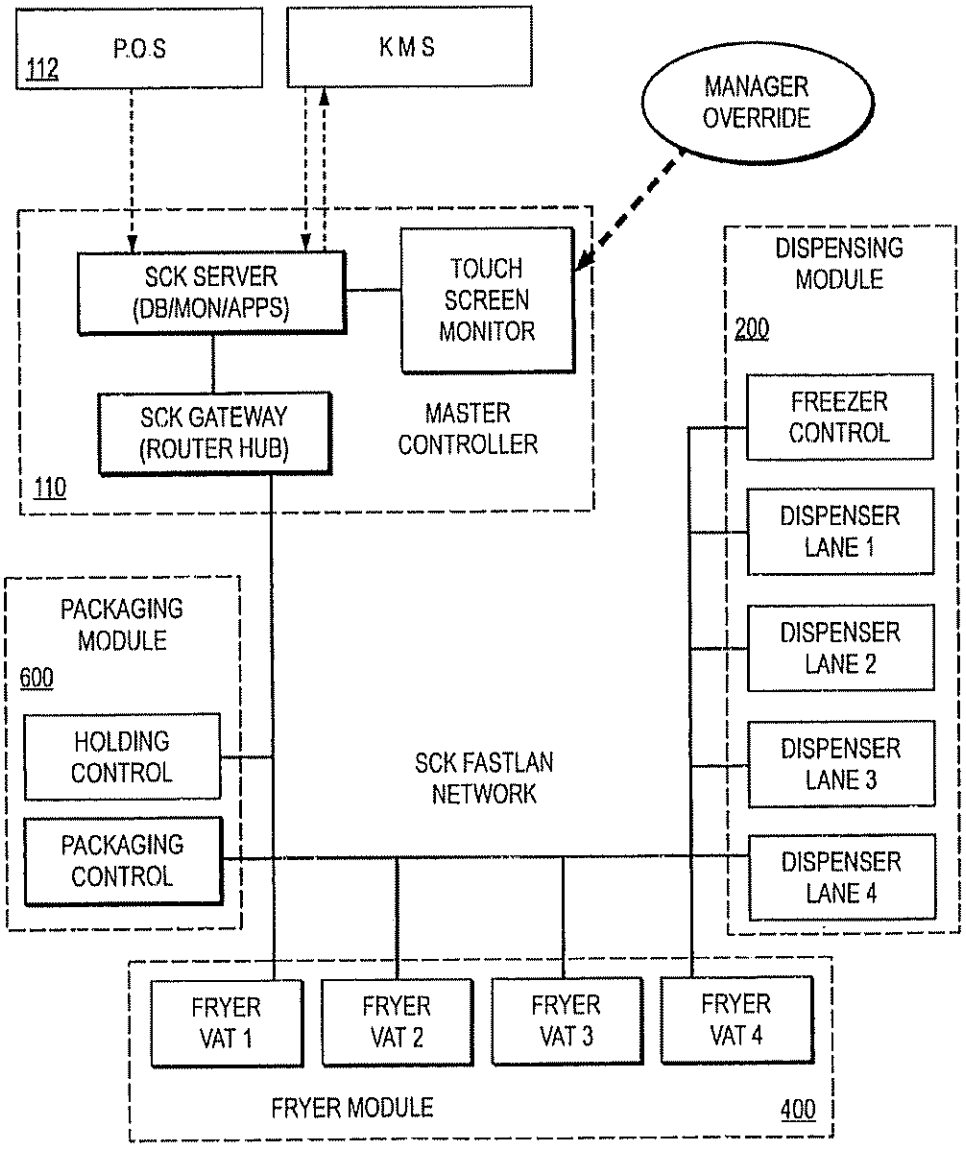

P.O.S
112
KMS
MANAGER OVERRIDE
SCK SERVER (DB/MON/APPS)
TOUCH SCREEN MONITOR
SCK GATEWAY (ROUTER HUB)
MASTER CONTROLLER
110
DISPENSING MODULE
200
FREEZER CONTROL
DISPENSER LANE 1
DISPENSER LANE 2
DISPENSER LANE 3
DISPENSER LANE 4
PACKAGING MODULE
600
HOLDING CONTROL
PACKAGING CONTROL
SCK FASTLAN NETWORK
FRYER VAT 1
FRYER VAT 2
FRYER VAT 3
FRYER VAT 4
FRYER MODULE
400

FIG. 70

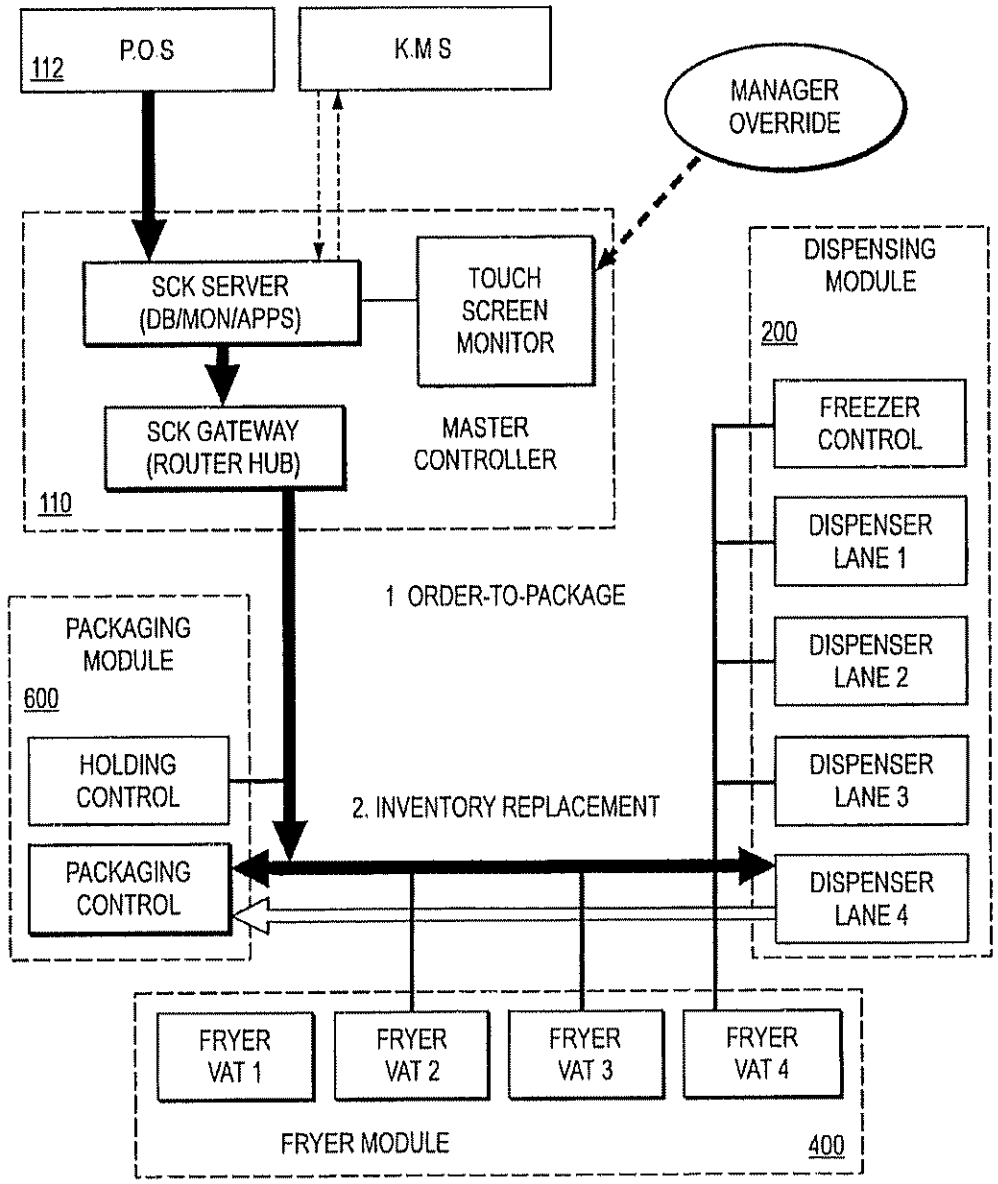

P.O.S
112
K.M.S
MANAGER OVERRIDE
SCK SERVER (DB/MON/APPS)
TOUCH SCREEN MONITOR
SCK GATEWAY (ROUTER HUB)
MASTER CONTROLLER
110
DISPENSING MODULE
200
FREEZER CONTROL
DISPENSER LANE 1
DISPENSER LANE 2
DISPENSER LANE 3
DISPENSER LANE 4
1 ORDER-TO-PACKAGE
PACKAGING MODULE
600
HOLDING CONTROL
PACKAGING CONTROL
2. INVENTORY REPLACEMENT
FRYER VAT 1
FRYER VAT 2
FRYER VAT 3
FRYER VAT 4
FRYER MODULE
400

FIG. 71

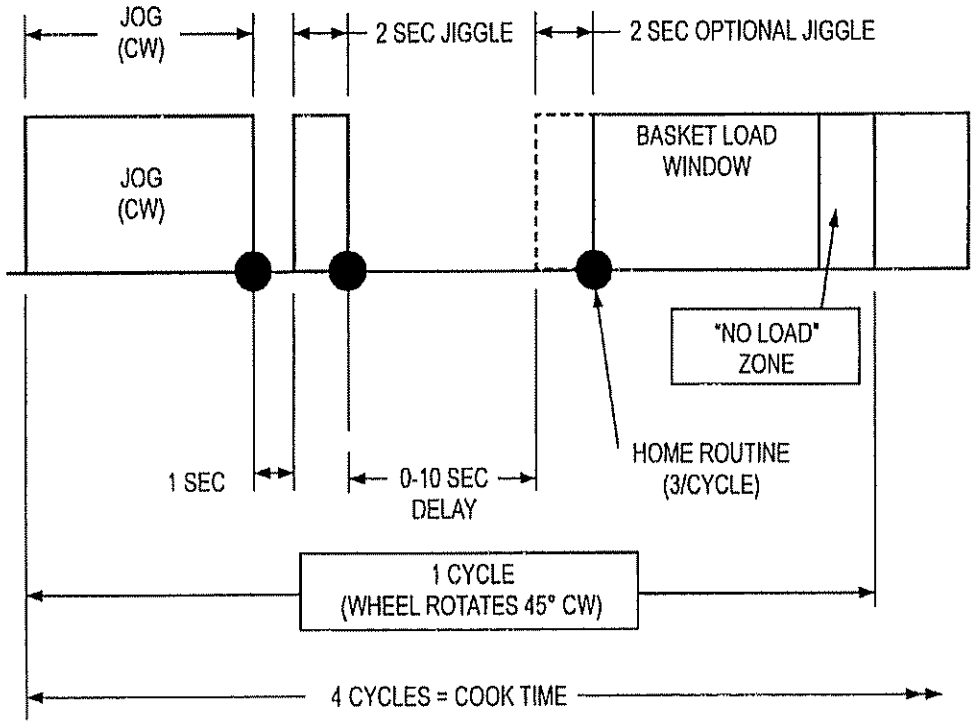

JOG
(CW)
2 SEC JIGGLE
2 SEC OPTIONAL JIGGLE
JOG
(CW)
BASKET LOAD
WINDOW
"NO LOAD"
ZONE
HOME ROUTINE
(3/CYCLE)
1 SEC
0-10 SEC
DELAY
1 CYCLE
(WHEEL ROTATES 45° CW)
4 CYCLES = COOK TIME

FIG. 72

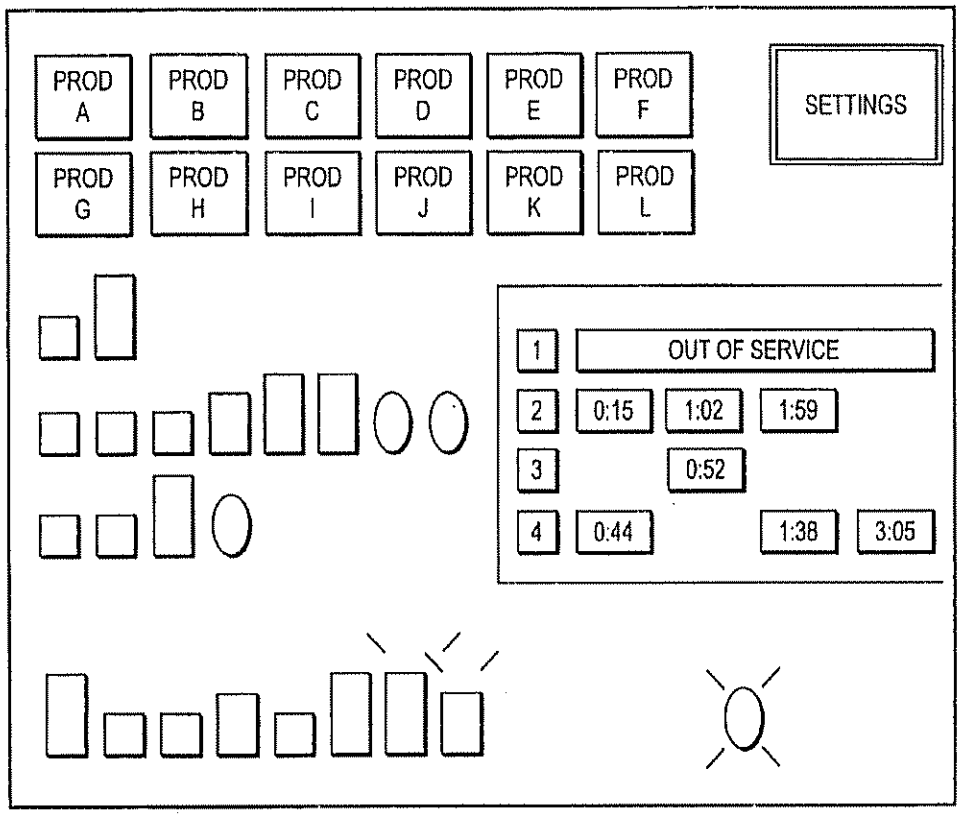
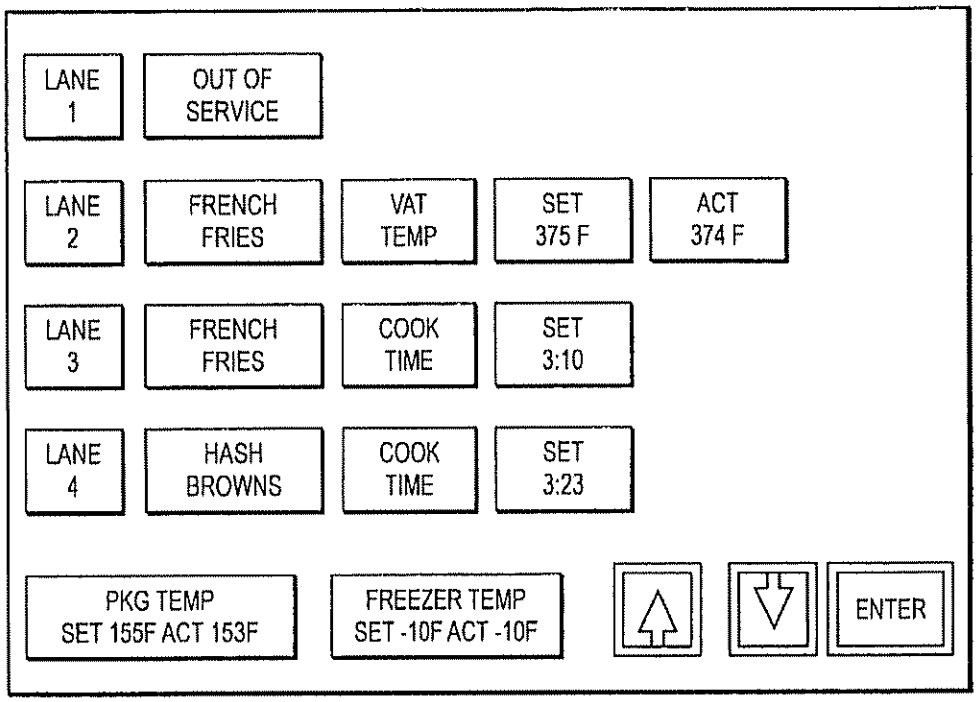

PROD A
PROD B
PROD C
PROD D
PROD E
PROD F
PROD G
PROD H
PROD I
PROD J
PROD K
PROD L
SETTINGS
1
OUT OF SERVICE
2
0:15
1:02
1:59
3
0:52
4
0:44
1:38
3:05

FIG. 73


LANE 1
OUT OF SERVICE
LANE 2
FRENCH FRIES
VAT TEMP
SET 375 F
ACT 374 F
LANE 3
FRENCH FRIES
COOK TIME
SET 3:10
LANE 4
HASH BROWNS
COOK TIME
SET 3:23
PKG TEMP SET 155F ACT 153F
FREEZER TEMP SET -10F ACT -10F
ENTER

AUTOMATED FOOD PROCESSING SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation of U S application Ser No 10/127,390, filed Apr 22, 2002, the disclosure of which is hereby incorporated by reference

FIELD OF THE INVENTION

[0002] The invention relates to automated food processing More particularly, the invention relates to automated food dispensing, frying and packaging into individual portion-sized containers such as at a quick-service type restaurant

BACKGROUND OF THE INVENTION

[0003] In restaurants, especially quick service (fast food) restaurants, fast, consistent, efficient and safe food preparation is essential for a successful operation The quality of the prepared food depends in large part on the consistency of food preparation The food must be cooked under correct conditions for the proper time

[0004] Consistency in food preparation can vary as a result of many factors For example, people engaged in food preparation often must perform multiple tasks at frequencies that vary with time because of constantly varying customer demand throughout the day For example, lunchtime and dinnertime may be extremely busy while other periods may be relatively slow The product mix can vary from hour to hour and day to day As a result, the consistency and quality of food may vary Difficulties in proper scheduling of food production during peak and non-peak periods can cause customer delays and/or stale, wasted or unusable food

[0005] Food preparation can be labor intensive, and thus, the labor cost can be a large portion of the total cost of the prepared food An additional problem is that in sparsely populated and other areas where quick service restaurants are located, such as along interstate highways, for example, recruiting sufficient numbers of suitable employees is difficult

[0006] Quick service restaurants must be able to effectively meet a variable customer demand that is time dependent and not subject to precise prediction As a result, stores relying totally on human operators will at times be over-staffed and at other times be under-staffed Also, problems and potential problems can exist in restaurants where people directly prepare food Health and safety concerns can also be present where food is prepared directly by people By reducing or minimizing human contact with food and food cooking equipment, health and safety concerns can also be reduced or minimized For example, in the frying of foods, some type of hot fluid, such as cooking oil or shortening must be utilized The cooking temperatures required can present a concern for health and safety

[0007] Although quick service restaurants have existed for many years and now number in the tens of thousands, such establishments utilize manual labor to prepare and process food While there have been various improvements in commercial equipment used for cooking food in quick service restaurants, such restaurants are believed to be substantially all manually operated and relatively labor intensive

[0008] Accordingly, a need exists for an automated, commercially suitable food dispensing, cooking and packaging device, system and method for fried foods that can be operated with a minimum of human intervention, control and maintenance More particularly, a need exists for an automated device, system and method that is capable of, without human labor, frying various food products in desired quantities, such as French fries, seasoning the cooked food and packaging the cooked food in individual portion-sized containers

SUMMARY OF THE INVENTION

[0009] In accordance with the present invention, an automated food processing system and method is provided The automated food processing system and method in accordance with the invention allows food to be dispensed, fried and packaged in a suitable container or alternatively dispensed to a food holding area for subsequent processing by a human operator

[0010] In accordance with one aspect of the present invention, an automated module system for dispensing, frying and packaging food into individual portion-sized containers is provided In one embodiment, any suitable automated dispensing device can be used. In another embodiment, the system includes an automated dispensing module capable of dispensing a desired quantity of food to be fried, an automated fry module adjacent the dispensing module to receive and fry the quantity of food dispensed from the dispensing module and to produce and dispense a quantity of fried food and an automated packaging module adjacent the fry module to receive and package the fried food from the fry module into an individual portion-sized container

[0011] Advantageously, in one embodiment, the three modules are independent from each other and can be operated independently Plus, in one embodiment, any one of the modules can be deactivated and a human operator can manually perform the function of the deactivated module with manually operated equipment

[0012] In accordance with another aspect of the invention, optionally an automated seasoning device is present to apply seasoning to the food

[0013] Typically, the automated dispensing module in accordance with the invention in one embodiment is capable of dispensing one or more of uncooked or unheated French fries, chicken nuggets, hash browns, chicken patties and fish filets or similar types of food items to be cooked and/or heated

[0014] In accordance with another aspect of the invention, the automated dispensing module includes a freezer, a storage container located in the freezer for containing food to be dispensed, structure for dispensing a predetermined quantity of food from the storage container into a secondary or dump container, with the structure for dispensing and the secondary or dump container being located in the freezer, and structure for dispensing the quantity of food from the secondary or dump container to a location outside of the freezer

[0015] In accordance with another aspect of the present invention, the fry module of the automated modular system

includes a fry vat for containing and heating cooking oil, at least one circular fry wheel having at least a generally circular perimeter in a plurality of compartments, each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel, which radial axis is disposed above the normal operating level of the frying oil or the cooking oil in the fry vat A drive mechanism is provided for rotating the fry wheel In one aspect of the invention, any suitable type of automated fry device can be utilized

[0016] In accordance with another aspect of the present invention, a control system is provided for causing the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation (such as about 2-10°, for example) to simulate shaking of a fry basket Such control can be accomplished electronically by devices known to those skilled in the art

[0017] In another embodiment, food is delivered from the fry module to a cooked food holding device, which can comprise a heated holding bin or bins

[0018] In accordance with still another aspect of the present invention, the automated packaging module includes a rotatable food dispensing member having an inlet location to receive a quantity of cooked food at a discharge location to discharge cooked food, the packaging module also including a food dispensing chute position to receive cooked food from the discharge location of the rotatable food dispenser, the food dispensing chute having a discharge location

[0019] In accordance with another embodiment of the invention, the automated modular system further includes a carton holding device for holding the individual portion-sized carton or container in position to receive food from the discharge location of the dispensing chute The packaging module may further include a rotatable food collecting member disposed to collect food from the discharge location of a dispensing chute that is not deposited into the individual portion-sized food container The so collected food may be subsequently deposited into the food dispensing chute for delivery to a container or alternatively to the rotatable food dispensing member or to a waste receptacle or chute

[0020] In accordance with another aspect of the invention, the automated packaging device includes a conveyor system for transporting filled individual portion-sized food containers from adjacent the filling location to a filled food container holding area, for subsequent pick-up by a human operator, for example In one embodiment, any suitable automated packaging device can be utilized

[0021] In accordance with another aspect of the present invention, an automated food carton-retrieving device is provided for retrieving and grasping individual portion-sized food containers The automated retrieving device comprises a moveable member for selectively grasping and releasing the food container In one embodiment, the retrieving device is capable of grasping and releasing an unerected food container on one side and the device further includes a second device for selectively grasping the unerected food container on the other side with structure for moving the retrieving device and the second device relatively apart when grasping the sides of the container to erect or partially erect the container

[0022] In another embodiment, an automated urging structure is provided for urging the container bottom upwardly relative to the sides of the container when the sides of the container are moved relatively apart

[0023] In accordance with another aspect of the invention, the automated modular system includes an electronic control system that receives current customer order information and the electronic control system causes the selection of a container from a plurality of different container sizes and further causes filling of food with the size of food container in response to a customer order In one aspect, the electronic control system can receive customer order information and controls the dispensing rate of food dispensed from the food dispensing module to the fry module which dispensing automatically determines the amount of food being fried without further intervention by the electronic control In one aspect, the control system can include a separate control system for each of the dispensing, fry and packaging systems or modules, each of which interface with a central control system, which in turn optionally interfaces with a POS (point-of-sale) system

[0024] In accordance with another aspect of the invention, the automated modular system is suitable for dispensing, frying and packaging French fries into individual portion-sized containers

[0025] In accordance with another aspect of the present invention, an automated method of dispensing, frying and packaging food into individual portion-sized containers is provided that includes dispensing a desired quantity portion of food to be fried from an automated dispensing module to an automated fry module and thereafter frying the portion of food dispensed from the dispensing module in the automated fry module adjacent the dispensing module to produce a quantity of fried food Thereafter, the quantity of fried food is dispensed from the fry module to a packaging module where the fried food dispensed from the fry module is packaged into individual portion-sized containers with an automated packaging module

[0026] In another aspect of the invention, the automated method further comprises seasoning the quantity of fried food with a seasoning device

[0027] In accordance with another aspect of the invention, the dispensing includes dispensing a predetermined quantity of food from the storage container into a secondary container located in a freezer and dispensing the quantity of food from the secondary container to a location outside of the freezer

[0028] In accordance with another aspect of the method of the present invention, the frying comprises a rotating fry wheel having at least a generally circular perimeter and a plurality of compartments, each compartment having an opening towards the perimeter, the food being contained in at least one of the compartments during the frying, the fry wheel being mounted for rotational movement relative to the radial axis of the fry wheel in a fry vat with the radial axis being disposed above a normal operating level of the cooking oil in the fry vat In accordance with this aspect of the invention, the automated method further includes containing a drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation to simulate shaking of a fry basket during frying

[0029] In accordance with another aspect of the invention, the packaging includes rotating a rotatable food dispensing

member having an inlet location to receive a quantity of cooked food in a discharge location to discharge cooked food, the food dispensing member being rotated to dispense food into a food dispensing chute position to receive cooked food from the discharge location of the rotatable food dispenser and thereafter dispensing said food from the dispensing chute to a container to be filled

[0030] In accordance with another aspect of the invention, the method further includes holding an individual portion-sized carton or container positioned to receive food from the dispensing chute with an automated carton holding device

[0031] In accordance with still another aspect of the invention, the method further includes collecting food dispensed from the discharge location of the dispensing chute that is not deposited into the individual portion-sized food container with a rotatable food collecting member disposed to collect such not deposited food

[0032] In accordance with another aspect of the method, the method includes electronically coordinating the operation of the three modules or devices within an electronic control system In one embodiment, the method further includes electronically receiving current customer order information by the electronic control system which causes selection of a container from a plurality of different sized containers and filling the container with food of the ordered size of food container in response to a customer order by the packaging module In accordance with another aspect of the method, customer order information is electronically received and the dispensing rate of food dispensed from the food dispensing module to the fry module is controlled, which dispensing automatically determines the amount food being fried without further intervention by the electronic control system

[0033] In accordance with another aspect of the present invention, an automated dispensing device for dispensing a quantity of food to be subsequently cooked is provided In one embodiment, the automated dispensing device includes a freezer or refrigerated compartment, a storage container located in the freezer for containing food to be dispensed, structure for dispensing a predetermined quantity of food from the storage container into a secondary or dump container, the structure for dispensing the predetermined quantity of food being located in the freezer, and structure is provided for dispensing the quantity of food from the secondary or dump container in the freezer to a location outside of the freezer

[0034] In one embodiment, the structure for dispensing a predetermined quantity of food includes a vibratory conveyor typically located in the freezer below the storage container. The structure for dispensing may further include a device for determining or sensing the quantity of food that has been deposited in the secondary container and structure is provided for terminating the operation of the structure for dispensing when a predetermined quantity of food is sensed in the secondary container

[0035] In accordance with another aspect of the present invention, the automated dispensing device includes structure for dispensing a predetermined quantity of food that comprises a food magazine capable of dispensing individual pieces of food on a piece by piece basis In accordance with a more specific aspect of this embodiment, the magazine comprises dual rotatable spiral flights with the spiral flights having a spacing therebetween to allow placement of a food item, such as a chicken patty, for example, to be supported by both spiral flights

[0036] In accordance with another aspect of the invention, the magazine dispenser is suspended from a slide mechanism permitting removal of the magazine from the freezer or refrigerated compartment. A plurality of the magazines can be located on a single slide mechanism An array of the magazines may be located in the freezer, such as a 3×5 array or a 3×4 array, for example

[0037] In one embodiment, a separate drive motor is associated with each food dispensing magazine for selectively rotating spiral flights of a magazine dispenser for dispensing a desired number of the food items The drive motor may also be located in the freezer

[0038] In accordance with another aspect of the invention, an automated method of dispensing a quantity of food to be cooked is provided The method includes storing food items in a storage container located in the freezer, dispensing food items from the storage container to a conveyor, conveying the food items on the conveyor to a secondary or dump container located in the freezer, monitoring the amount of food items delivered to the secondary container, terminating delivery of the food items to the secondary container when a desired amount of food items are determined to be present in the secondary container as determined by the monitoring, and dispensing the food items from the secondary container and out of the freezer by at least partially inverting the secondary container In accordance with another aspect of this embodiment, a freezer or refrigerated compartment is not utilized

[0039] In accordance with another aspect of the present invention, a device for the automated frying of foods is provided The device in one embodiment includes a fry vat for containing and heating cooking oil, at least one circular fry wheel having at least a generally circular perimeter and a plurality of compartments with each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel which radial axis is disposed above the normal operating level of the frying oil in the fry vat A drive mechanism is provided for rotating the fry wheel and a control system is included for causing the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of rotation (such as about 2-10°, for example) to simulate shaking of a fry basket Such control can be accomplished electronically by devices known to those skilled in the art

[0040] In accordance with another aspect of the present invention, the small amount of rotation is in the range of from about 20 to about 200 The back and forth rotation in one direction may be of a larger angle or amount of rotation than of the rotation in the other direction

[0041] In one embodiment, a control system is provided that causes periodic incremental rotation of the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and to move the compartments out of the cooking oil for subsequent discharge of the food from the compartment In one embodi-

ment, the periodic incremental rotation is based on 360° divided by the number of compartments in the fry wheel

[0042] In accordance with another aspect of the present invention, a control system is provided for operating the drive mechanism to rotate the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and out of the cooking oil for subsequent discharge of the food from the compartment, wherein the control system adjusts the speed of rotation based on the level of cooking oil in the fry vat In one embodiment, the control system causes incremental periodic rotation of the fry wheel and the control system adjusts the period of time between incremental rotations based on the level of cooking oil sensed in the fry vat The period of time between incremental rotations can also be based on the temperature of the cooking oil in the fry vat

[0043] In accordance with another aspect of the invention, a curved baffle is provided that is disposed in the fry vat adjacent the axial periphery of the portion of the fry wheel that is disposed in the cooking oil for preventing food contained in one or more of the fry wheel compartments from falling out of the compartments

[0044] In accordance with another aspect of the present invention, an automated method of frying food in a fry vat having a heated cooking oil contained therein is provided The method includes placing food in a fry wheel compartment, each of the compartments having an opening towards the perimeter of the fry wheel, rotating the fry wheel so that the compartment containing the food travels submerged in the heated cooking oil and periodically rotating the fry wheel back and forth in a relatively small amount of rotation to simulate shaking of the fry basket while the food is submerged in the cooking oil In accordance with another aspect of the method of the present invention, the method comprises rotating the fry wheel in one direction to cause the food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and to move the food out of the cooking oil for subsequent discharge of the food from the compartment, wherein the speed of said rotating is related to the level of cooking oil in the fry vat In accordance with this aspect of the present invention, the rotating may comprise incremental periodic rotation with the period of time between incremental periodic rotations being based on the level of cooking oil sensed in the fry vat The period of time between incremental periodic rotations may also be based on the temperature of the cooking oil in the fry vat

[0045] In accordance with another aspect of the present invention, an automated method of packaging cooked food, which may be food such as French fries, chicken nuggets and other types of food, in an individual portion-sized container is provided The method includes delivering a quantity of a cooked food to a rotatable dispensing member, rotating the dispensing member to cause the food items to fall from one or more compartments of the dispensing member into a food dispensing chute and thereafter dispensing the food from the chute and depositing the food into the individual portion-sized food container

[0046] In accordance with one aspect, the method may further include weighing the food in the chute before dispensing the food to the container

[0047] In accordance with another aspect of the invention, the method includes applying seasoning to the food and may further include applying the seasoning by using gravity to cause the seasoning to travel through a nozzle and onto the food

[0048] In accordance with another aspect of the invention, the method further includes shaking the individual portion-sized food container after the dispensing The shaking may be automated and can include back and forth movement of the container through an arc as desired, and may be in a generally vertical axis The arc may be a generally circular arc and the rotating back and forth may encompass an arc in the range of from about 3° to about 20° In addition, the container may be raised and lowered before, during or after the rotating to further simulate shaking or in connection with further container handling

[0049] In accordance with another aspect of the invention, when dispensing food from the chute to the individual portion-sized container, some of the dispensed food is not deposited into the individual portion-sized container and the method further includes collecting the not deposited food Typically, the not deposited food will be collected in a collection device that returns the not deposited food to the chute for subsequent dispensing In one embodiment, the collection member is rotatable and can be rotated to deposit the collected food to the chute This helps to ensure that the not deposited food is subsequently deposited into a container on a first-in, first-out or a generally first-in, first-out basis

[0050] In accordance with another aspect of the present invention, an automated method of packaging food, including food such as French fries, in an individual portion-sized container is provided that includes delivering a quantity of food to a food dispensing chute, selecting and holding with an automated device an individual portion-sized container of a desired size from a plurality of different sizes of individual portion-sized containers that can be selected and held by the automated device. The selected individual portion-sized container is moved by the automated device to a location for receiving food from the dispensing chute and food is dispensed from the chute and into the container The method may further include depositing the filled food container onto a conveyor by operation of the automated device and transporting the deposited container by the conveyor to a human operator food pickup location

[0051] In accordance with another aspect of the foregoing method, the individual portion-sized food container is unerected and the method further includes after the selecting, erecting the selected individual portion-sized food container by the automated device In one embodiment, the automated device includes a partial vacuum suction device for holding the individual portion-sized food container and the holding includes applying a partial vacuum through a suction device to the food container The food container can be released by reducing or eliminating the vacuum applied by the suction device to the food container sufficiently to cause the food container to be disengaged from the automated device

[0052] In accordance with another embodiment of the method, the filled food container is placed in an upright position on a transportable member or container-receiving receptacle which in one embodiment contains a single food container and is maintained in an upright position on the

transportable member by cooperation of the recessed volume of the transportable member and the food container

[0053] In accordance with another aspect of the invention, the transporting is performed by a magnetic conveyor

[0054] In accordance with still another aspect of the invention, an automated device for packaging cooked food into a desired container, which may be an individual portion-sized food container is provided. The device includes a rotatable food dispensing member having an inlet location to receive a quantity of the cooked food and a discharge location to discharge the cooked food. A food dispensing chute is positioned to receive the cooked food from the discharge location of the rotatable food dispenser and the dispensing chute has a discharge location. In one embodiment, the dispensing chute has a food holding area for holding a quantity of the cooked food deposited therein. A suitable weighing device can be associated with the dispensing chute to weigh the food that is contained in the chute or in the holding area of the chute. In one embodiment, the weighing device is a load cell.

[0055] In accordance with another aspect of the invention, the automated device includes a food carton or container holding device for holding the food carton in position to receive food from the discharge location of the dispensing chute. The carton holding device can include an axially rotatable generally vertically extending elongated first member and a second member that extends from the elongated member, the second member having a gripping member for gripping a food container, which may be an individual portion-sized food container. In one embodiment, the gripping member comprises a suction cup. A vacuum source may be supplied to the suction cup to create at least a partial vacuum, allowing the container to be held. In one embodiment, the carton holding device is capable of moving the food container through an arc of about or of at least about 180° and in which the carton holding device is capable of moving the food container up and down.

[0056] In accordance with another aspect of the present invention, the automated device comprises a conveyor system for transporting filled individual portion-sized food containers from adjacent the filling location to a filled container holding area. The conveyor system may comprise in one embodiment a continuous loop raceway and a plurality of discrete moveable food container receptacles that are moveable along the raceway. The conveyor system may include a continuous moveable loop having at least one magnetic element capable of magnetically attracting one of the moveable receptacles at a time for causing movement of the receptacle corresponding to movement of the magnetic element. A plurality of the magnetic elements may be spaced apart along the moveable loop.

[0057] In one embodiment, structure is provided for preventing movement of the discrete receptacles when the structure for moving the discrete receptacles along the raceway is activated. The structure for preventing movement can be a barrier that is disposed across the raceway. In one embodiment, the barrier is selectively moveable and in another embodiment the barrier is fixed. In one embodiment, the barrier prevents movement of the receptacles only for a receptacle that has a food carton or container disposed thereon. In this embodiment, the barrier may be located at a height that is above the top of the receptacles located on the conveyor system adjacent the barrier.

[0058] In accordance with another aspect of the invention, an automated device is provided to retrieve and grasp a food container, which may be an individual portion-sized food or French fry container or carton. The automated retrieving device includes a member for selectively grasping and releasing the food container and for moving the moveable member horizontally and linearly.

[0059] In accordance with another aspect of the invention, a magazine is provided for holding a plurality of food containers in an unerected state.

[0060] In accordance with another aspect of the invention, the automated device includes a retrieving device that is capable of grasping and releasing an unerected food container on one side and further includes a second device for selectively grasping the unerected food container on the other side. A structure for moving the retrieving device and the second device relatively apart when grasping the sides of the container is provided. The automated device may further include an automated urging means for urging the container bottom upwardly relative to the sides of the container when the retrieving device and the second device are moved relatively apart when grasping the container.

[0061] In accordance with another aspect of the invention, the food dispensing member is a rotatable wheel having an open central area and an outer at least generally circular rim. The rotatable wheel has a plurality of open compartments spaced apart about the circular rim that extend inwardly from the circular rim and open interiorly of the circular rim. A baffle may be provided to prevent food contained in the one or more of the open compartments from falling out of the compartments when the wheel is rotated until the compartment is in position over the food dispensing chute. The baffle may be curved to follow the curvature of the inner part of the wheel and may also be perforated. The automated device may further include a rotatable food collecting member that is disposed to collect food dispensed from the discharge location of the dispensing chute which food is not deposited into a container held in position at the discharge location. Typically, the collection member will have a discharge location to discharge collected food. In one embodiment, the discharge location is the food dispensing chute. The collecting member may be a rotatable food collecting wheel having an open central area and an outer circular rim having a plurality of open compartments spaced apart about the circular rim that extend inwardly from the circular rim and that are open towards the rim interior. The rotatable food dispensing member and the rotatable food collecting member can be rotatable in one direction to discharge food at a discharge location and into a food dispensing chute and can be rotatable in an opposite direction to discharge the food at a second discharge location which may be to a waste chute. The discharge to the waste chute feature can be activated, for example, when the food is held in the dispensing device for too long a period of time.

[0062] The packaging device may also include an automated seasoning device for depositing a predetermined quantity of seasoning to food contained in the packaging device.

[0063] In accordance with another aspect of the invention, the device for applying seasoning includes a seasoning delivery tube having an inlet and a discharge location. A seasoning delivery head is positioned to deliver seasoning to

the food to be seasoned with the head in communication with the outlet of the delivery tube and located below the inlet of the delivery tube Structure is provided for depositing a predetermined quantity of seasoning into the inlet of the delivery tube so that the quantity of seasoning falls by gravity through the delivery tube and into and through the seasoning head and onto the food to be seasoned Typically, the structure for depositing the predetermined quantity of seasoning will receive seasoning from a bulk hopper by gravity feed The quantity of seasoning to be dispensed can be determined volumetrically, for example

BRIEF DESCRIPTION OF THE DRAWINGS

[0064] **FIG. 1** is a perspective view of an automated food processing system in accordance with the invention;

[0065] **FIG. 2** is a perspective view of an alternate embodiment of a food processing system in accordance with the present invention;

[0066] **FIG. 3** is a schematic view, partly in section, of the food processing system of **FIG. 1**;

[0067] **FIG. 4** is a side elevation view of a portion of a bulk food dispensing device in accordance with the present invention;

[0068] **FIG. 4A** is a side elevation view, partly in section, of an alternative embodiment for a portion of the dispensing device illustrated in **FIG. 4**;

[0069] **FIG. 5** is a top plan view of a portion of the bulk food dispensing device in accordance with the present invention;

[0070] **FIG. 6** is a side elevation view, partly in section, of a bulk food dispensing device in accordance with the present invention and also illustrating a portion of a device for frying food in accordance with the present invention;

[0071] **FIG. 7** is a perspective view of a magazine-type dispenser that can form part of the food dispensing device of the present invention;

[0072] **FIG. 8** is a partial side elevation view of the magazine dispenser of **FIG. 7**;

[0073] **FIG. 9** is a perspective view of a magazine-type dispenser array that can be utilized in the dispenser of the present invention;

[0074] **FIG. 10** is a fragmentary view of the device of **FIG. 9**;

[0075] **FIG. 11** is a top plan view of a food frying device in accordance with the present invention;

[0076] **FIG. 12** is a front elevation view of the food frying device of **FIG. 11**;

[0077] **FIG. 13** is a partial fragment sectional view along line **13-13** of **FIG. 11**;

[0078] **FIG. 14** is a fragmentary sectional view of a portion of the food frying device of **FIG. 11**;

[0079] **FIG. 15** is a sectional view along line **15-15** of **FIG. 14**;

[0080] **FIG. 16** is a perspective view of a drive mechanism for the food frying device of **FIG. 11**;

[0081] **FIG. 17** is a fry basket for use in the frying device of **FIG. 11**;

[0082] **FIG. 18** is a fragmentary sectional view along line **18-18** of **FIG. 17**;

[0083] **FIG. 19** is an enlarged, fragmentary elevation sectional view of a portion of **FIG. 13**;

[0084] **FIG. 20** is an alternate view along line **13-13** of **FIG. 11**;

[0085] **FIG. 21** is a sectional view along line **21-21** of **FIG. 20**;

[0086] **FIG. 22** is an enlarged fragmentary view of a portion of **FIG. 21**;

[0087] **FIG. 23** is an alternate embodiment of a fry wheel in accordance with the present invention;

[0088] **FIG. 24** is another alternate embodiment fry wheel in accordance with the present invention;

[0089] **FIG. 25** is a front perspective view of a packaging device in accordance with the invention;

[0090] **FIG. 26** is a rear perspective view of the device of **FIG. 25**;

[0091] **FIG. 27** is a top plan view of the device of **FIG. 25**;

[0092] **FIG. 28** is a side elevation view, partially in section and partially broken away of the packaging device of **FIG. 25**;

[0093] **FIG. 29** is a front elevation view of the device of **FIG. 25**;

[0094] **FIG. 30** is a front perspective view of a portion of an automated container handling system in accordance with the invention;

[0095] **FIG. 31** is a top plan view of the container handling system of **FIG. 30**;

[0096] **FIG. 32** is a side elevation view, partially broken away of the automated container handling system of **FIG. 30**;

[0097] **FIG. 33** is a rear elevation view of the container handling system of **FIG. 30**;

[0098] **FIG. 34** is a front perspective view of the container handling system of **FIG. 30** shown in another operative position;

[0099] **FIG. 35** is a top plan view of the container handling system of **FIG. 34**;

[0100] **FIG. 36** is a side elevation view, partially broken away of the container handling system of **FIG. 34**;

[0101] **FIG. 37** is a rear elevation view of the container handling system of **FIG. 34**;

[0102] **FIG. 38** is a front elevation view of a portion of a container handling apparatus in accordance with the invention;

[0103] **FIG. 39** is a front elevation view of another portion of the container handling apparatus of **FIG. 34**;

[0104] **FIGS. 40-42** illustrate a front diagrammatic elevation view illustrating a portion of the container handling apparatus in accordance with the invention;

[0105] FIGS. 43-44 illustrate a side elevation view, partly in section, of a portion of the food packaging apparatus in accordance with the invention;

[0106] FIG. 45 is a top plan view of a food packaging device in accordance with the present invention;

[0107] FIG. 46 is a perspective view of a container-receiving receptacle in accordance with the present invention;

[0108] FIG. 47 is a top plan view of the device of FIG. 47;

[0109] FIG. 48 is a sectional view along line 48-48 of FIG. 47;

[0110] FIG. 49 is a cross-sectional view along line 49-49 of FIG. 47 and further including a portion of a conveyor system in accordance with the present invention;

[0111] FIG. 50 is a sectional view along line 50-50 of FIG. 49;

[0112] FIG. 51 is a front elevation view of a carton useful in accordance with the present invention;

[0113] FIG. 52 is a rear elevation view of a carton useful in accordance with the present invention;

[0114] FIG. 53 is a sectional view along line 53-53 of FIG. 52;

[0115] FIG. 54 is a bottom plan view of the container of FIG. 51;

[0116] FIG. 55 is a sectional view along line 55-55 of FIG. 57;

[0117] FIG. 56 is a perspective view showing use of the food container of FIG. 51;

[0118] FIG. 57 is a perspective view of a food container useful in accordance with the present invention;

[0119] FIG. 58 is an alternate embodiment perspective view of a container useful in accordance with the invention;

[0120] FIG. 59 is a development view of the carton of FIG. 51;

[0121] FIG. 60 is a side elevation view of the carton of FIG. 51;

[0122] FIG. 61 is a sectional view of a portion of the food packaging device of FIG. 25;

[0123] FIG. 62 is a sectional view of a portion of a food storage device in accordance with the present invention;

[0124] FIG. 63 is a sectional view of the food storage device of FIG. 62;

[0125] FIG. 64 is a side elevation view, partly in section, a hood system in accordance with the present invention;

[0126] FIG. 65 is a perspective view of an automated seasoning device in accordance with one aspect of the invention;

[0127] FIG. 66 is a side elevation view of the seasoning device of FIG. 65;

[0128] FIG. 67 is a front elevation view of the seasoning device of FIG. 65;

[0129] FIG. 68 is a top plan view of the seasoning device of FIG. 65;

[0130] FIG. 69 is a diagrammatic view of a control system in accordance with the present invention;

[0131] FIG. 70 is a diagrammatic view of a control system in accordance with the present invention;

[0132] FIG. 71 is a diagrammatic view of a frying cycle in accordance with the present invention;

[0133] FIG. 72 is a schematic illustration of a sample touch screen monitor useful in accordance with the invention; and

[0134] FIG. 73 depicts another touch screen layout in accordance with the present invention

DETAILED DESCRIPTION OF THE INVENTION

[0135] General

[0136] In accordance with the present invention, an automated food processing system and method is provided. The automated food processing system and method in accordance with the invention allows food to be dispensed, fried and packaged in a suitable container or alternatively dispensed to a food holding area for subsequent processing by a human operator

[0137] Referring to the Figures generally and in particular to FIGS. 1 and 3, there is illustrated an automated food processing system 100 in accordance with the invention. Automated food processing system 100 includes a food dispensing device 200, a fry device 400 and a food packaging device 600. In accordance with one embodiment of the present invention, each of dispensing, fry and packaging devices 200, 400 and 600, respectively, can be constructed and are sometimes illustrated in "modular" construction or form. By "modular" construction or form it is meant that dispensing, fry and packaging devices 200, 400 and 600, respectively, can exist and be contained in separate cabinets, for example, and also operate independently of the other devices. Thus, if one of dispensing, fry and packaging devices 200, 400 and 600, respectively, are inoperative or are otherwise deactivated, the function of the deactivated or inoperative device can be performed manually. For example, food to be fried could be manually dispensed in place of dispensing device 200. Alternatively, food to be fried could be fried in a conventional fry vat after being dispensed from dispensing device 200 in place of using fry device 400 and food that is dispensed and fried in dispensing and fry devices 200 and 400, respectively, could, in turn, be packaged manually, for example

[0138] To facilitate such modular construction and use, each of dispensing, fry and packaging devices 200, 400 and 600, respectively, can be contained in a separate wheeled cabinet, 202, 402 and 602, respectively, as illustrated in FIG. 1. Alternatively, dispensing, fry and packaging devices 200, 400 and 600, respectively, could be mounted as a single unit or in a single cabinet or in "non-modular form," as desired, or more than one of such devices 200, 400 and 600 could be so mounted or combined

[0139] A suitable control system for the dispensing, fry and packaging devices is also provided. As will be described

more completely hereafter, in one embodiment, the control system includes a central control system **110** that can interface with a point-of-sale system **112** The central control system will communicate with separate subcontrol systems **114, 116** and **118**, one for each of the dispensing, fry and packaging devices **200, 400** and **600**, respectively Alternatively, a single central control system (not shown) could be utilized in place of individual control systems for each of devices **200, 400** and **600** Similarly, as another alternative, a single central control system could be utilized to control the overall operation of automated food processing system **100** as well as controlling the individual functions and aspects of dispensing, fry and packaging devices **200, 400** and **600**

[0140] The basic operations of dispensing device **200**, fry device **400** and food packaging device **600** will now be briefly discussed and discussed in detail hereafter

[0141] Briefly, dispensing device **200** functions to dispense a quantity of food to be fried to fry device **400** In one aspect of the invention, any suitable food dispensing device can be utilized Dispensing device **200** can include a cabinet **202** to house the components of dispensing device **200** In one embodiment, cabinet **202** will be refrigerated, preferably below 32° F so that the food contents therein will remain frozen This allows the food stored in dispensing device **200** to remain therein for a long period of time, much longer than if the contents were merely refrigerated (above freezing) or merely at room temperature

[0142] In the illustrated embodiment, dispensing device **200** includes an uncooked bulk food dispensing container **204** Uncooked bulk food dispensing container **204** may be utilized for food such as French fries or chicken nuggets, for example Other types of food may also be contained in a dispenser such as uncooked bulk food dispensing container **204**. Typically, those types of food would be in the form of relatively small pieces compared to relatively large food pieces such as chicken patties, for example

[0143] For relatively large food pieces, a large food dispensing container is utilized In one embodiment, the large food dispensing container is in the form of a magazine food dispenser **206**

[0144] Food dispensed from a dispenser of dispensing device **200** is deposited on a conveyor **208** that, in turn, directs the deposited food to a secondary or dump container **210** for subsequent discharge from dispensing device **200**

[0145] In the illustrated embodiment, uncooked bulk food dispensing container **204**, magazine food dispenser **206**, conveyor **208** and secondary container **210** are contained in cabinet **202**, which is a refrigerated environment, preferably maintained below freezing (32° F or lower)

[0146] While any suitable conveyor can be utilized in one aspect, conveyor **208** is preferably a vibratory conveyor, vibrated by a suitable vibratory mechanism that vibrates a conveyor body **214** Conveyor body **214** may take the form of a suitably shaped tray, for example

[0147] By containing the foregoing components in a refrigerated and preferably frozen environment, consistency in food preparation and dispensing is achieved, thereby contributing to the overall efficient, effective and uniform performance of automated food processing system **100**

[0148] Secondary container **210** can be of a form as desired and includes suitable weighing mechanism **216** to permit a determination of the quantity of food contained in secondary container **210** Weighing mechanism **216** can be any suitable device to weigh the contents or otherwise determine the amount of food in secondary container **210** Weighing mechanism **216** may comprise a load cell or a mechanism for determining the volume of food deposited into secondary container **210**, for example In this manner, the amount of food that is charged to fry device **400** at a particular time can be determined In addition, weighing mechanism **216** can be operated during operation of conveyor **208** and the operation of conveyor **208** continued until a desired amount of food is deposited in secondary container **210** In this manner, a precise amount of food can be delivered to secondary container **210** thereby permitting consistency and uniformity in the portion of food that is delivered to fry device **400** This is also important to ensure that a sufficient quantity of food is being cooked by automated food processing system **100**

[0149] Prior to activation of dumping mechanism **218**, discharge door **220** of cabinet **202** is opened by operation of a door opening device which can be any suitable device as desired and in the illustrated embodiment is a cylinder **222** attached to discharge door **220** and moveable up and down in the direction of arrow B Cabinet **202** is preferably insulated with a suitable insulating material **224** that is also provided in discharge door **220** The provision of a suitable insulating material is important, particularly since dispensing device **200** will typically be located proximate or adjacent fry device **400** that operates at a substantially elevated temperature, thereby typically generating substantial heat

[0150] In the illustrated embodiment, dispensing device **200** includes four dispensing lanes from which food is discharged from dispensing device **200** and to a suitable location such as fry device **400**. After dispensing through discharge door **220**, cylinder **222** is activated to close discharge door **220** Similarly, dumping mechanism **218** of secondary container **210** is activated to return secondary container **210** to its upright position to receive more food

[0151] Fry device **400** includes a fry wheel **404**, a fry vat **406** for containing and heating a suitable cooking oil and a drive mechanism **408** for suitably rotating fry wheel **404** It is to be understood that in accordance with one aspect of the invention any suitable frying device can be utilized

[0152] In the illustrated embodiment of **FIGS. 3 and 11-16**, fry device **400** includes a plurality, in this case four, of separate fry wheels **404, 410, 412** and **414**, as well as four separate fry vats **416, 406, 420** and **418** and a separate drive mechanism **408** for each fry wheel, each dedicated to a particular one of fry wheels **404, 410, 412** and **414**

[0153] In one embodiment, a separate drive mechanism is provided for each of fry wheels **404, 410, 412** and **414** and can be suitably located in cabinet **402**, preferably in a location that is above the level of cooking oil present in the associated one of fry vats **416, 406, 420** and **418**, respectively

[0154] The suitable rotation of each of fry wheels **404, 410, 412** and **414** can be as desired to direct food articles loaded therein down and through the fry vat until reaching the other side of the fry vat whereupon the food articles are

discharged. The rotation can be either continuous or a periodic incremental rotation. For example, a suitable drive mechanism can be provided to periodically rotate fry wheel **410** in a desired rotational increment, which may be based on the number of compartments contained in fry wheel **410**. In the illustrated embodiment of **FIG. 13**, for example, fry wheel **410** comprises eight food compartments **422**, **424**, **426**, **428**, **430**, **432**, **434**, and **436**. Each of food compartments **422-436** is a perimeter food compartment and open to the perimeter or exterior of fry wheel **410**. Each of fry wheels **404**, **412** and **414** can be similarly configured.

[0155] As described in more detail hereafter, each of compartments **422-436** is formed from a perforated curved compartment forming member **510**.

[0156] In the rotation of fry wheel **410**, a periodic incremental rotation can be based upon 360° divided by the number of compartments. Thus, for example, in the illustrated embodiment of **FIG. 13**, each periodic rotation would consist of a rotation of 360° divided by eight compartments or a periodic rotation increment of 45°. Thus, as illustrated in **FIG. 13**, the food contained, in this case French fries, in compartments **424-430** would remain in cooking oil **454** contained in fry vat **406** for all or part of four incremental rotations, after which the food would be discharged from fry wheel **410** in the next incremental rotation thereof. For example, as illustrated in **FIG. 13**, compartment **422** is ready to receive a charge of food to be fried, compartment **424** has a charge of food that has been just immersed in cooking oil **454**. Cooking oil **454** is at a level H as illustrated in **FIG. 13**, which is dependent upon the amount of food contained in compartments **422-436** that are submerged in cooking oil **454**.

[0157] Similarly, compartment **426** has food contained therein that has gone through two incremental 45° rotations of fry wheel **410**, compartment **428** has food contained therein that has undergone three incremental rotations and food compartment **430** has food contained therein that has undergone four incremental rotations of fry wheel **410** and compartment **432**, which is now empty, has discharged the food contained therein upon the last incremental rotation of fry wheel **410**. Thus, upon the next incremental rotation of fry wheel **410**, which is in the clockwise direction as shown by arrow B of **FIG. 13**, the food contained in food compartment **430**, which in this case is a quantity of French fries **455**, will be discharged from compartment **430** to the food packaging device which is hereafter briefly described.

[0158] Upon discharge of food, which in this case is a quantity of French fries from one of compartments **422-436** of a fry wheel, such as fry wheel **410** as illustrated in **FIG. 3**, the food is deposited onto an inlet chute **604** of food packaging device **600**.

[0159] From inlet chute **604**, the food from inlet chute **604** received from fry wheel **410** is deposited into rotatable food dispensing member **606**. Typically, rotatable food dispensing member **606** will be compartmented into a plurality of compartments that are arrayed along the periphery of rotatable food dispensing member **606**.

[0160] Rotatable food dispensing member **606** has a discharge location to discharge the food deposited therein. The discharge location is generally located towards an upper portion of rotatable food dispensing member **606**. A food dispensing chute mechanism **608** is positioned to receive cooked food from the discharge location of rotatable food dispensing member **606**. In a preferred embodiment, food dispensing chute mechanism **608** incorporates a device for weighing or otherwise determining the quantity of food that has been deposited into food dispensing chute mechanism **608**. This ensures that when food is dispensed from food dispensing chute mechanism **608** a minimum quantity of food will be dispensed, thereby ensuring that a container **611** or other package that is to receive the food from mechanism **608** will receive a desired charge.

[0161] Food packaging device **600** preferably also includes a suitable automated container handling system **610**. Automated container handling system **610** is capable of, in a preferred embodiment, selecting container **611** of a desired size, retrieving and grasping container **611**, erecting unerected container **611** into an erected form and holding the erected container **611** in position to receive food dispensed from food dispensing chute mechanism **608**.

[0162] After food container **611** receives food from food dispensing chute mechanism **608**, automated container handling system **610** is capable of moving container **611** having food deposited therein to a container receiving receptacle **612** which receptacle **612** can be transported via a conveyor system **614** to a desired location for subsequent pickup of container **611** having food contained therein by a human operator, for example.

[0163] Preferably, a food overflow collection member is provided to collect any food dispensed by food dispensing chute mechanism **608** that is not deposited into container **611**. In one embodiment, the overflow food collection device is a rotatable food collection member **613**. Overflow food collection member **613** functions to collect food dispensed by food dispensing chute mechanism **608** that is not received in container **611** and to recycle food collected by overflow food collection member **613** into food dispensing chute mechanism **608** for subsequent dispensing to a container in a first-in, first-out manner so that overflow food is promptly recycled to dispensing chute **608** for dispensing to a container.

[0164] Preferably, food packaging device **600** is configured to include a provision by which food contained in dispensing device **600** is routed to waste where it is not desired to dispense such food into a food container. Such a condition could arise, for example, if food is held for too long a period in food packaging device **600**. This function may be accomplished, for example, by providing a waste discharge location which can be in the form of a waste chute **615** to which food from rotatable food dispensing member **606** and overflow food collection member **613** can be directed. In one embodiment, chute mechanism **608** is lowered and member **606** is rotated to dispense food to chute mechanism **608**, which in turn dispenses into member **613**. Member **613** is rotated counterclockwise to deliver food to waste chute **615**. This process can be continued until all of the food in device **600** is so emptied, if desired.

[0165] Preferably, a suitable structure for applying a desired quantity of seasoning to food contained in food packaging device **600** is provided. In the embodiment illustrated in **FIG. 3**, a food seasoning device **616** is provided. Food seasoning device **616** can be any suitable seasoning device as desired. In one embodiment, food seasoning

device **616** dispenses a desired quantity of seasoning from a bulk storage container through a delivery tube and onto food located in rotatable food dispensing member **606**

[0166] Preferably, and in the embodiment illustrated in **FIG. 3**, a food seasoning device **616** is provided that directs a desired quantity of seasoning onto food that is contained in a bottom portion of rotatable food dispensing member **606** and inlet chute **604** via a seasoning dispensing head **618**

[0167] Preferably, conveyor system **614** is composed of a raceway **620** that is an endless loop around the periphery of the top surface of cabinet **602** of food packaging device **600**, which in one embodiment can be a modular, wheeled cabinet. Conveyor system **614** causes container receiving receptacle **612** to travel around raceway **620** to a food container pickup location **622** where a human operator can pickup food containers having food therein. Preferably, conveyor system **614** includes structure for stopping movement of a container/receiving receptacle **612** at a predetermined location when carrying a food container, such as at food container pickup location **622**. Such structure in one embodiment may comprise a gate structure **928** or **928'** of **FIG. 45** and **FIGS. 25-27**, respectively, that extends across at least a portion of raceway **620** in the vicinity of the predetermined location. Any suitable type of barrier structure can be utilized to prevent the desired movement. Most preferably, gate structure **928** or **928'** will be located at a height that is above the top of the receptacle when located on conveyor system **614** so that movement of container/receiving receptacle **612** is prevented or stopped only for a receptacle **612** that has a food container **611** disposed thereon. Note that the pickup location can be configured as desired and slightly different configurations **622** and **622'** are shown in **FIG. 45** and **FIGS. 25-27**, respectively.

[0168] Referring to **FIG. 2**, there is illustrated an alternate embodiment of an automated food processing system **101** in accordance with the invention. Automated food processing system **101** includes a food dispensing device **201** which is similar to food dispensing device **200**, previously briefly described, where like reference numerals represent like elements. Food dispensing device **201** includes fewer uncooked bulk food dispensing containers **204** and additional magazine food dispensers that are similar to magazine food dispenser **206**, previously referred to. Otherwise, dispensing device **201** is similar to dispensing device **200** previously described.

[0169] Automated food processing system **101** also includes fry device **400**, which has been described.

[0170] One primary distinction between automated food processing system **100** and automated food processing system **101** is that automated food processing system **101** does not include an automated packaging device such as automated packaging device **600**. In place of food packaging device **600**, a food storage device **635** is provided. Food storage device **635** allows food cooked by food frying device **400** to be stored in a heated environment for subsequent manual processing. As configured in **FIG. 2**, food storage device **635** includes separate heated product receiving receptacles **637**, **639**, **641** and **643**. Each receptacle **637**, **639**, **641** and **643** is dedicated to receiving food from a respective one of fry wheels **410**, **412**, **414** and **404**, respectively. In addition, each receptacle **637-643** can have placed therein a suitable container to receive food, such as handled trays **645**, **647**, **649** and **651**.

[0171] As illustrated in **FIG. 2**, a food item F is being discharged from fry wheel **414** down a chute **653** and into handled tray **649** contained within heated receptacle **641**. Food item F can be stored therein for a period of time until it is ready for subsequent processing.

[0172] Food Dispensing Device

[0173] Referring to the Figures generally and in particular to **FIGS. 1-10**, there is illustrated various embodiments of food dispensing devices and portions thereof in accordance with the invention.

[0174] In one embodiment, food dispensing device **200** is illustrated or partially illustrated in **FIGS. 1 and 3-8**. Food dispensing device **200** includes a cabinet **202**, bulk uncooked food dispensing containers **204**, **205** and **207**, magazine food dispenser **206**, **209**, **211** and **213**, and a suitable conveyor system for each lane **234**, **236**, **238** and **240** of food dispensing device **200**. Any suitable number of magazine dispensers can be used for a particular lane, such as one, two, three, four, five or more, and the illustrated embodiment of four is merely an example. As configured in **FIG. 1**, for example, lane **234** receives material from bulk hopper **204**, lane **236** receives food material from bulk hopper **205**, lane **238** receives food material from bulk hopper **207** and lane **240** receives dispensed food from magazine food dispensers **206**, **209**, **211** and **213** as will be described hereinafter in greater detail, particularly with respect to food dispensing device **201** of **FIG. 2**, for example.

[0175] Each lane **234**, **236**, **238** and **240** dispenses food that is subsequently directed to fry wheels **410**, **412**, **414** and **404**, respectively.

[0176] The components of lane **238** will now be described in detail and it is to be understood that the components of lanes **234** and **236** are similar. Lane **238** includes uncooked bulk food dispensing container **207** and a food handling system **242** which in this embodiment is identical for each lane **234**, **236**, **238** and **240** as well as for each lane of food dispensing device **201**. It should be noted that food handling system **242**, as for example, illustrated in **FIGS. 3-6** is depicted with respect to lane **240** and that food handling system **242** is the same for each lane **234**, **236**, **238** and **240**.

[0177] Food handling system **242** includes conveyor system **208**, secondary container **210**, weighing mechanism **216** and dumping mechanism **218**. Conveyor system **208** includes vibratory mechanism **212** and conveyor body **214**.

[0178] Uncooked bulk food dispensing container **204** can be of a shape and dimension generally as desired. Preferably, uncooked bulk food dispensing container **204** has an upper opening to permit a supply of food to be placed in uncooked bulk food dispensing container **204**. Upper opening **244** as illustrated is located in an upper rear portion of uncooked bulk food dispensing container **204** and can be conveniently accessed via a rear door **246** of cabinet **202**. Rear door **246** preferably is insulated with suitable insulation material **224**.

[0179] Uncooked bulk food dispensing container **204** is composed of a pair of opposed upper sidewalls **248**, a pair of generally opposed lower sidewalls **250** and front and rear walls **252** and **254**, respectively, which connect together upper sidewalls **248** and **250** to provide uncooked bulk food dispensing container **204**. Front sidewall **252** includes a

lower portion **252'** that extends inwardly from top to bottom to further facilitate discharge of food contained in uncooked bulk food dispensing container **204** Preferably, lower generally opposed sidewalls **250** are slightly indented from top to bottom to facilitate the discharge of food that may be contained therein

[0180] Uncooked bulk food dispensing container **204** includes a bottom opening **256** that permits the discharge of food contained therein Bottom opening **256** can be configured as desired and in the illustrated embodiment the entire bottom of uncooked bulk food dispensing container **204** is open In the illustrated embodiment, uncooked bulk food dispensing container **204** is particularly suited for use with food such as French fries and chicken nuggets as well as other types of food of relatively small size

[0181] Uncooked bulk food dispensing container **204** is suitably mounted within cabinet **202** While a suitable mounting structure can be utilized, it is preferred to utilize a structure that will minimize heat transfer from the exterior and through cabinet **202** to uncooked bulk food dispensing container **204**, particularly where cabinet **202** is refrigerated, especially where temperatures below freezing are utilized In that regard, front mounting bracket **258** and rear mounting bracket **260** each are configured to minimize heat transfer from cabinet **202** to uncooked bulk food dispensing container **204** In that regard, front mounting bracket **258** and rear mounting bracket **260** include openings, **258'** and **260'**, respectively, to minimize such heat transfer and to maximize airflow around the containers **204, 205, 207** and dispensers **206, 209, 211** and **213** Similarly, materials of low thermal conductivity can also be utilized, if desired, for brackets **258** and **260** Generally, to minimize heat transfer and to maximize airflow, the surface area contact and cross-sectional area of mounting brackets **258** and **260** should be minimized to reduce heat transfer and "hot spots" on uncooked bulk food dispensing container **204**

[0182] As illustrated in **FIGS. 3 and 4**, for example, food contained in uncooked bulk food dispensing container **204** passes through bottom opening **256** and onto conveyor body **214** which in the illustrated embodiment is a suitably dimensioned pan Conveyor body **214** is suitably mounted to vibratory mechanism **212** to effect vibration of conveyor body **214** as well as food contained therein and food contained in uncooked bulk food dispensing container **204**, and in particular the lower portion of container **204** This vibration facilitates the discharge of food from uncooked bulk food dispensing container **204** and causes food contained in conveyor body **214** to travel in the direction of arrow G Any suitable conveyor system can be used in accordance with one aspect of the invention

[0183] A preferred type of vibratory mechanism is available from FMC Technologies, Inc of Chicago, Ill marketed under the model F-010-B and DF-010-B Vibratory mechanism **212** is preferably an electromagnetic vibrating mechanism Vibratory mechanism **212** in one embodiment produces a vibrating stroke at the surface of conveyor body **214** The stroke results from the action of an electromagnet that pulls conveyor body **214** sharply down and backward and then allows it to spring up and forward Typical vibratory mechanisms of this type run at about 3,600 vibrations/minute at 60 Hz power The power of the vibrating stroke can be controlled by a suitable drive module as is known in the art In one embodiment, vibratory mechanism **212** can be operated at about 85% of full power during filling of secondary container **210** with food For the first part of a fill cycle of secondary container **210**, vibratory mechanism **212** can be run continuously, then pulsed by turning its power on and off periodically so that vibratory mechanism **212** operates about 50% of the time to finish filling secondary container **210** with a desired quantity of food, thereby providing better control on the last part of the food charged to secondary container **210**

[0184] Food dispensing device **200** preferably includes a suitable mechanism to determine the weight or volume of a charge of food delivered by conveyor system **208** to secondary container **210** The amount may be determined either by weight or volume, for example In the illustrated embodiment, weighing mechanism **216** is operatively interfaced with secondary container **210** to provide an indication of the weight of food contained in secondary container **210** The weight sensed in secondary container **210** by weighing mechanism **216** is communicated with control system **114** of food dispensing device **200** Control system **114** monitors and controls the operative functions of food dispensing device **200** as hereinafter described in greater detail

[0185] Optionally, a level sensor can be employed in uncooked bulk food dispensing container **204** to provide an indication of the amount of food stored therein that is available for dispensing Any suitable level indicator known in the art can be utilized in accordance with the invention such as photoelectric, weight, turning fork and others, for example

[0186] Secondary container **210** can be considered as a dump container and as associated therewith, dumping mechanism **218** for rotating secondary container **210** through an arc as indicated by arrow B sufficiently to dump the contents of secondary container **210** Any suitable dumping mechanism can be utilized Illustrated dumping mechanism **218** includes a dump cylinder **264** that is secured to a base **266** Dump cylinder **264** can selectively rotate a drive gear or wheel **268** that, in turn, is operatively associated with a follower gear or wheel **270** to cause rotation of follower gear or wheel **270** Secondary container **210** is rigidly secured to follower gear or wheel **270** so that when follower gear or wheel **270** is rotated by drive gear or wheel **268** secondary container **210** is rotated through an arc that causes secondary container **210** to rotate forward to a dumping position as illustrated in phantom lines in **FIG. 3** indicated by reference numeral **210'** Such movement is caused by extension of dump cylinder **264** Similarly, retraction of dump cylinder **264** moves secondary container **210** from the dump position indicated by reference numeral **210'** to the upright position indicated by reference numeral **210** in **FIG. 3** where secondary container **210** is ready to receive a charge of food from conveyor system **208**, which in the illustrated embodiment the food is French fries FF

[0187] An alternative embodiment for secondary container **210** is illustrated in **FIG. 4A** Secondary container **210'** is composed of a pair of opposed spaced apart sidewalls **211** (only one sidewall **211** is illustrated and is depicted in a half-moon configuration) and a pair of sidewalls **213*a*** and **213*b***, oriented in a V-shaped relationship when container **210'** is configured to receive food from conveyor body **214** Sidewall **213*a*** is mounted for pivotal movement about apex

215 of sidewalls 213*a* and 213*b* Such movement is accomplished by a drive mechanism similar to cylinder 264, drive gear 268 and driven gear 270, which in this embodiment are cylinder 264', drive gear 268' and driven gear 270', which gear 270' is attached to sidewall 213*a* When cylinder 264' is extended, sidewall 213*a* is caused to pivot downwardly as indicated by arrow AA to the position of sidewall 213*a* shown in phantom, thereby, causing the contents (French fries FF) of container 210' to be dumped Sidewalls 211 act as sidewall guides for sidewalls 213*a* and 213*b* when sidewall 213*a* is in a lowered position, in which case sidewalls 213*a* and 213*b* act as a chute or slide

[0188] Control system 262 coordinates the operation of the various functions of food dispensing device 200 For example, when food dispensing device 200 is ready to dump a charge of food from secondary container 210 out of food dispensing device 200, control system 262 activates cylinder 222 to open discharge door 220 thereby permitting the food charge in secondary container 210 to be dumped by dumping mechanism 218 through open discharge door 220 After dumping of the food charge is completed, control system 114 causes dump cylinder 264 to be retracted thereby returning secondary container 210 to a position ready to accept a further charge of food from conveyor system 208 Cylinder 222 has one end rigidly secured to cabinet 202 or some other suitable location and the other end of cylinder 222 is attached to discharge door 220 Typically, discharge door 220 will have a suitable guide mechanism, which may be tracks, slots or other suitable apparatus to guide discharge door 220 to its open and closed positions Cylinder 222 is operable to move door 220 up and down as indicated by arrow B in FIG. 6 to thereby open and close discharge door 220 as desired In the illustrated embodiment, discharge door 220 extends across all four dispensing lanes 226, 228, 230 and 232 If desired, a separate discharge door could be provided for each of dispensing lanes 226, 228, 230 and 232 In addition, control system 262 causes activation of cylinder 222 to close discharge door 220 to prevent heat from entering into cavity 272 of food dispensing device 200 in which the food and various dispensing mechanisms are contained as illustrated in FIGS. 3 and 6, for example

[0189] Food dispensing device 200 can contain suitable refrigeration components 274 such as within a lower portion of cabinet 202 as shown schematically in FIG. 1 In accordance with the preferred embodiment of food dispensing device 200, refrigeration components 274 provide sufficient cooling to provide a below freezing temperature environment in cavity 272 Alternatively, suitable refrigeration components can be provided exteriorly of cabinet 202 and even at a remote location as desired In addition, a storage compartment 276 and a storage compartment door 278 may also be provided in cabinet 202 An upper side access door may also be provided to permit operator access to the interior of cavity 272 where uncooked bulk food dispensing containers 204 and/or magazine food dispensers 206 and/or 209, 211 and 213 are located

[0190] Referring to FIGS. 2 and 7-10, there is illustrated another embodiment of food dispensing device 201 in accordance with the present invention

[0191] Food dispensing device 201 has many similarities to food dispensing device 200 previously described where like reference numerals represent like elements Thus, food dispensing device 201 includes cabinet 202, four product dispensing lanes 226, 228, 230 and 232 with each such lane incorporating conveyor system 208, secondary container 210, vibratory mechanism 212, conveyor body 214, weighing mechanism 216, dumping mechanism 218, discharge door 220, cylinder 222, insulating material 224, food handling system 242, upper opening 244, rear door 246, uncooked bulk food dispensing container 204 which is associated with product dispensing lane 234, a dump cylinder 264 for each product dispensing lane, cavity 272, refrigeration components 274, storage compartment 276 and a storage compartment door 278 Product dispensing lanes 228, 230 and 232 each have associated therewith a plurality of magazine food dispensers 280-308 arrayed to provide in the embodiment illustrated in FIG. 9 five magazine food dispensers per product dispensing lane in which there are three product dispensing lanes serviced by the foregoing magazine food dispensers Consequently, magazine food dispensers are configured in a three-by-five array and are suspended from a magazine food dispenser support 310 as shown in FIG. 9 Each row of three magazine food dispensers depends from magazine food dispenser support 310 via a slide assembly 312 Slide assembly 312 is similar to a drawer slide including a pair of first and second elongated telescoping left and right slides 314 and 316, respectively Suitable upper rollers 318 are mounted to magazine food dispenser support 310 and lower rollers 320 depend from magazine food dispensers 280-308 for traversing left and right elongated telescoping slides 314 and 316

[0192] Suitable mounting brackets 322 are provided which depend upwardly from magazine food dispenser support 310 for mounting to cabinet 202

[0193] In addition, suitable mounting brackets 324 are provided which depend downwardly from magazine food dispenser support 310 for mounting slide assembly 312 thereto allowing magazine food dispensers 280-308 to depend therefrom

[0194] Magazine food dispenser support 310 has a series of holes 326 and 328 therein Holes 326 can be provided to allow increased airflow and cooling Holes 328 can also be provided to provide increased airflow and cooling for magazine food dispensers 280-308

[0195] Each of magazine food dispensers 280-308 and 206, 209, 211 and 213 briefly discussed with respect to food dispensing device 200 are similar in construction Magazine food dispenser 206 will be discussed with respect to FIGS. 7 and 8 and it is to be understood that the other magazine food dispensers are of similar construction

[0196] Magazine food dispenser 206 includes a body or housing 330 that includes sidewalls 332 and 334, front walls 336 and 338 and corresponding rear walls (not shown) and can be attached in a removable manner if desired, including in a snap-on arrangement to facilitate cleaning Magazine food dispenser 206 also includes a top member or cover 340 having mounted thereover a drive mechanism 342. Drive mechanism 342 includes a drive gear or wheel 344 and a driven wheel or gear 346 Depending from each of drive wheel or gear 344 and driven wheel or gear 346 is a spiral flight that is vertically or generally vertically oriented relative to the longitudinal axis of spiral flights 348 and 350 If desired, a single spiral flight dispenser (not shown) could also be utilized

[0197] Body **330** of magazine food dispenser **206** can include substantial open portions such as front open portion **352** and a corresponding rear open portion (not shown) Such open portions may have a cover or access door thereover (not shown) Such open portions can be desirable to permit airflow through magazine food dispenser **206** since generally such dispenser will be contained in a refrigerated environment and such openings help ensure that food contained therein remains frozen or chilled as desired A vertical divider (not shown) can be provided between spiral flights **348** and **350** if desired

[0198] A plurality of generally vertically disposed and spaced apart rods **354**, **356** and **358** may be provided at the front of magazine food dispenser **206** adjacent spiral flights **348** and **350** and similar rods can be provided at the back of magazine food dispenser **206** Rods **354**, **356** and **358** prevent food pieces from falling out of spiral flights **348** and **350** and to maintain spiral flights **348** and **350** in a vertical orientation

[0199] Magazine food dispenser **206** has an open bottom **360** through which food pieces can be dispensed during operation

[0200] During operation, drive wheel **344** can be driven by a suitable electric motor, such as an electric motor **362**, **364** and **366** shown with respect to magazine food dispensers **280**, **282** and **284** in **FIG. 9** Alternatively, other drive devices could be used, including, for example, a rotary air or hydraulic cylinder Rotation of drive wheel **344** in a clockwise direction causes driven wheel **346** to rotate in a counterclockwise direction by virtue of the intermeshing or contact between drive wheel or gear **344** and driven wheel or gear **346** Such rotation causes corresponding rotation of spiral flights **348** and **350**, respectively Food contained by spiral flights **348** and/or **350** is moved downwardly by virtue of such rotation When such food reaches the bottom of spiral flights **348** and/or **350**, respectively, such food is discharged from magazine food dispenser **206** through open bottom **360** and onto conveyor system **208** for handling as previously described A single motor could be used to drive a plurality of dispensers **280**, **282** and **284**, etc through a suitable drive mechanism (not shown)

[0201] As shown in **FIG. 8**, pieces of food can be contained by magazine food dispenser **206** in two different ways For example, individual pieces of food may each be contained by a single elongated spiral flight **348** or **350** as shown with respect to food pieces F1 and F2, respectively. Food pieces F1 and F2 can be any type of desired food and may be a food item such as a hash brown, an individual portion pie, rectangular food patty, or other type of food as desired Chicken nuggets and other food can also be dispensed with the bulk dispenser previously described Larger items of food can span across portions of both elongated spiral flights **348** and **350** as illustrated with respect to food item F3, which may be a larger food item, such as a chicken patty, or other type of food article as desired Spiral flights **348** and **350** can be of a desired radial diameter so that the food piece or pieces that are to be contained and dispensed in magazine food dispenser **206** can be accommodated as illustrated in **FIG. 8** Each spiral can contain a food piece so that as illustrated in **FIG. 7**, the illustrated spirals of spiral flights **348** and **350** could each accommodate twelve food pieces such as food pieces F1 or F2 for a total of twenty-four food pieces or twelve food pieces such as food piece F3 of **FIG. 8** As will be appreciated, spiral flights having a greater or lesser number of flights can be used if desired to hold a greater or lesser number of food pieces, respectively

[0202] A suitable home position sensor **362'** can be utilized to indicate a home or start position of each of spiral flights **348** and **350** As illustrated in **FIG. 7**, a pair of position indicating sensors **362'** and **364'** are utilized and mounted on drive wheel **344** 180° apart for more precise locating of the position of spiral flights **348** and **350**. Sensors **362'** and **364'** can be proximity sensors that align with corresponding sensor pickups on the respective drive gear or motor for magazine food dispenser **206** (not shown)

[0203] Preferably, spiral flights **348** and **350** are offset by one rotation so that a single food item such as food item F1 or F2 in **FIG. 8** will be dispensed from one of either spiral flight **348** or **350** for each one-half rotation of spiral flights **348** and **350**

[0204] Preferably, food dispensing device **200** and food dispensing device **201** are constructed in modular form, an example of which is illustrated in **FIGS. 1 and 2**, respectively Wheels **368** are provided to permit cabinets **202**, **402** and **602** to be suitably transported across a relatively flat surface, such as a restaurant work area floor

[0205] Food Frying Device

[0206] Referring to the Figures generally, and in particular to **FIGS. 1-2** and **11-24**, there is illustrated fry device **400** and various components and alternative components thereof in accordance with the invention

[0207] In one embodiment, fry device **400** includes cabinet **402**, four fry wheels **404**, **410**, **412** and **414**, four fry vats **406**, **416**, **418** and **420**, four drive mechanisms **408**, one for each of fry wheels **404**, **410**, **412** and **414** Each fry vat **406**, **416**, **418** and **420** is dimensioned to contain a desired volume of a suitable cooking oil Each fry vat **406**, **416**, **418** and **420** is dedicated to one of fry wheels **404**, **410**, **412** and **414**, respectively

[0208] In operation in the preferred embodiment, fry device **400** is positioned to receive the food dispensed from a food dispensing device, such as food dispensing device **200** and food dispensing device **201** Consequently, it is advantageous to position fry device **400** adjacent food dispensing device **200** or **201** as illustrated in **FIGS. 1 and 2**, respectively A suitable control panel **456** can be provided and located in a suitable location, such as on the side of cabinet **402** In the illustrated embodiment, control panel **456** contains a separate display for each of fry wheels **404**, **410**, **412** and **414** referred to by reference numerals **456***a-d*, respectively Control panels and displays **456***a-d* can include information such as set cycle time, oil temperature, oil level as well as controls to adjust cycle time and oil temperature, for example

[0209] Referring to **FIG. 13**, there is illustrated fry wheel **410** Fry wheel **410** includes two opposed circular spaced apart circular disks **458***a* and **458***b* Disks **458***a* and **458***b* can include a plurality of apertures **460** as desired to reduce wheel weight and to provide circulation of cooking oil and to permit passage of water vapor therethrough, such as during frying food products, for example A fry wheel axle **462** is provided to which disks **458***a* and **458***b* are mounted

Axle **462** is suitably mounted, typically and preferably for rotation with respect to fry vat **406** at a location above the normal level of cooking oil or range of levels of cooking oil that will be encountered in fry vat **406** during operation

[**0210**] In one embodiment, outer peripheral edge **464** of each of disks **458***a* and **458***b* include a plurality of teeth **466**

[**0211**] Teeth **466** can be utilized to drive fry wheel **410** in a manner as hereinafter described Referring to **FIGS. 14-16**, there is illustrated in sectional view of disk **458***a* of fry wheel **410**, a portion of which is located within fry vat **406** A drive wheel **468** is associated in operative position relative to teeth **466** located on outer peripheral edge **464** of disk **458***a* Drive wheel **468** can be formed from a disk of material of a suitable thickness having a circumferential groove **470** therein Circumferential groove **470** is typically at least or slightly greater than the thickness of disk **458***a* in the area where drive wheel **468** and disk **458***a* are juxtaposed as illustrated in **FIGS. 14 and 15** A series of spaced apart pins **472** extend across circumferential groove **470** and are radially arrayed and spaced from the center of drive wheel **468** Drive wheel **468** includes a central aperture **474** through which a drive axle **476** can be mounted In operation, drive wheel **468** is rotated by drive axle **476** with drive wheel **468** being positioned a fixed distance from disk **458***a* so that pins **472** mesh with teeth **466** when rotated as illustrated in **FIG. 14** thereby causing rotation of disk **458***a* and consequently fry wheel **410** in a direction of rotation opposite to the rotation of drive wheel **468**, as indicated by arrows K and L of **FIG. 14**

[**0212**] It is to be understood that any suitable drive wheel and drive arrangement can be utilized For example, in place of drive wheel **468** with pins **472**, a drive arrangement could be utilized in which a drive gear is utilized to mesh with a corresponding gear located around the periphery of disk **458***a* and/or **458***b*, for example Alternatively, a friction drive system could be utilized in which a friction drive wheel would contact the edge of one or both of circular disks **458** which could be of a design having no teeth therealong, such as illustrated in alternative embodiment wheels **479** and **481** described hereafter Since the wheel will have cooking oil thereon, the coefficient of friction between the drive wheel and fry wheel will be decreased Care should be taken to assure that when using a friction drive, sufficient pressure is maintained between the driving wheel and the fry wheel

[**0213**] Referring to **FIG. 16**, there is illustrated a drive mechanism for driving drive wheel **468** The drive mechanism includes an electric motor **478**, a gear reduction drive **480**, an output shaft **482**, a drive pulley wheel **484**, a driven pulley wheel **486** and a drive belt **488** extending around drive pulley wheel **484** and driven pulley wheel **486** to drive axle **476** which thereby drives drive wheel **468** since the end **476***a* of axle **476** is fixed in aperture **474** with respect to drive wheel **468** A shear pin **490** can be located in a shear pin aperture **492** of drive wheel **468** to retain axle **476** in a fixed position relative to drive wheel **468** Axle **476** is suitably contained within an axle journal **494** which, in turn, is mounted to frame **496** to permit movement of axle **476** relative to axle journal **494** and frame **496** Similarly, motor **478** and gear reduction drive **480** are suitably mounted to frame **496** If desired, motor **478** may be a stepper motor

[**0214**] Typically, it is important that the fry wheel is rotated in periodic increments for a compartment to be aligned with a respective discharge slide **498** of fry device **400** or other slide, ramp or discharge location after a periodic rotation Typically, the leading edge **500** of a compartment bottom, such as compartment bottom **432'** of compartment **432** as shown in **FIG. 13** is aligned with the upper edge of fry vat **406** or the top edge of discharge chute **498** associated therewith to allow the contents of compartment **432** to be discharged therefrom. As illustrated in **FIG. 13**, the contents of compartment **432** have already been discharged from fry wheel **410** This is particularly important where incremental rotation of fry wheel **410** is utilized as opposed to a continuously moving fry wheel. Thus, for incremental rotation it is desirable for bottom edge **500** of compartment **432** to be aligned with discharge **498** or the upper edge **406'** of fry vat **406** In order to accomplish this, a stepper motor can be utilized to drive fry wheel **410** Alternatively, or in addition, the position of the baskets can be sensed and their position adjusted accordingly to assure that all baskets are in the correct position for loading and discharge during operation Also, utilizing location sensors allows use of a simple DC or AC motor, as opposed to a stepper or servo motor Any suitable sensor can be utilized in conjunction with a control system to control operation of the fry wheel drive motor. Suitable sensors include proximity, magnetic reed, Hall Effect, photoelectric and capacitive sensors Such sensors are well known in the art and consequently a detailed description of those sensors is not included herein

[**0215**] In accordance with another aspect of the invention, it should be understood that the height of cooking oil in one of fry vats **406**, **416**, **418** and **420**, such as the level of cooking oil indicated by reference letter H in **FIG. 13** in fry vat **406** will increase or decrease depending upon the amount of food that is submerged underneath the surface of cooking oil contained in fry vat **406** Thus, as illustrated in **FIG. 13**, compartments **424**, **426**, **428** and **430** each have a charge of food, in this case French fries **455** contained therein Each compartment contains approximately one pound of French fries **455** Consequently, there are about four pounds of French fries that are beneath the surface level H of cooking oil contained in fry vat **406** This quantity of submerged food raises the level H of cooking oil in fry vat **406** This increase in the level of cooking oil can cause the food to be submerged and therefore cooked for a longer of period of time in the cooking oil For example, contrast the level of cooking oil depicted in **FIG. 13** with the level of cooking oil depicted in **FIG. 20** in which a charge of French fries **455** is contained only within compartment **426** This results in a substantially reduced level of cooking oil H' as indicated in **FIG. 20** Thus, the control system for fry device **400** can be adjusted to take into account for different levels of cooking oil which can be sensed by a suitable sensor as is known by those skilled in the art (not shown) Where rotation of fry wheel **410** is done incrementally after a period of time elapses, the period between incremental rotations can be increased or decreased as desired based on the level of cooking oil present in fry vat **406** For example, in the situation illustrated in **FIG. 13**, the duration between incremental rotation of fry wheel **410** could be decreased compared to the situation depicted in **FIG. 20** where the level H' of cooking oil is significantly lower than the level H of cooking oil in **FIG. 13**. This assumes that the temperature of cooking oil in each of the situations depicted in **FIGS. 13 and 20** is substantially the same Similarly, if a constant rotation fry wheel operation is utilized, such as where fry

wheel **410** would rotate constantly, the rotational speed could be increased to handle the situation depicted in **FIG. 13** compared to the speed of the wheel that would be utilized for the situation in **FIG. 20**, where the level H' of cooking oil in **FIG. 20** is significantly less than the level H of cooking oil in **FIG. 13**

[0216] Referring to **FIGS. 13 and 20**, frying device **400** can also include a fry wheel follower "or fry wheel liner"**502** which is supported by a fry wheel follower support **504** Fry wheel follower **502** is a curved perforated circular segment having a width approximately equal to the width of fry wheel **410** Fry wheel follower **502** is supported by a pair of fry wheel follower supports **504** that are spaced apart and connected by lateral supports **506** Fry wheel follower **502** prevents food pieces that are larger than the perforations in fry wheel follower **502** from falling from fry wheel compartments **422-436** during operation Preferably, the perforations in fry wheel follower **502** are composed of circular holes having a diameter of about 0.187 inches that are in staggered rows having a center-to-center hole distance of about 0.312 inches Fry vat **406** includes a suitable heating element **505**, illustrated in **FIGS. 13, 20** and **21**

[0217] Referring to **FIGS. 17-19** there is illustrated a curved compartment forming member **438** which is composed of two opposed sidewalls **508***a* and **508***b* that are interconnected by a curved J-shaped member **510** that forms compartment bottom **510***a* and compartment top **510***b* Preferably, a wiper **512** is suitably mounted to compartment member **510**

[0218] A plurality of compartment forming members **438** are mounted together in fry wheel **410** to provide a plurality of adjacent peripheral food compartments **422-436** as illustrated in **FIG. 13** As illustrated in **FIG. 13**, the top of one J-shaped member **510** abuts the bottom of adjacent J-shaped member **510** Thus, advantageously, a fastening member **514**, which can be a rivet, for example, that secures wiper **512** to compartment bottom **510***a* of one curved J-shaped member **510** will also pass through the compartment top **510***b* of the adjacent curved J-shaped member **510** Preferably, wiper **512** has a plurality of transversely extending grooves **516***a-f* that permit drainage of cooking oil therethrough as wiper **512** exits the cooking oil in fry vat **406**, for example

[0219] Referring to **FIG. 17**, opposed sidewalls **508***a,b* and curved J-shaped member **510** are perforated to permit the flow of cooking oil therethrough thereby promoting good heat transfer between the cooking oil contained in fry vat **406** and food contained in one of compartments **422-436** when immersed in cooking oil A suitable hole size is about 0.156 inches spaced center-to-center about 0.250 inches. Wiper **512** also ensures that close contact is maintained between the interface of fry wheel follower **502** and the top and bottom ends of each food compartment **422-436** which in each case will be bounded by one of wipers **512** Any suitable material can be used for wiper **512** such as rubber or Teflon, for example

[0220] As an alternative construction, compartments **422-436** could be constructed from curved J-shaped members **510** without opposed sidewalls **508***a* and **508***b*, in which case the compartment sidewalls could be formed from opposed circular disks **458***a* and **458***b* In addition, it should be appreciated by one skilled in the art that any desired compartment shape can be utilized in accordance with the invention as long as the food can be loaded into the compartment, kept within the compartment during immersion in the cooking oil and which compartment shape discharges the food from the fry wheel

[0221] Referring to **FIGS. 21 and 22**, there are illustrated further aspects of fry device **400**. **FIG. 21** is a sectional view along line **21-21** of **FIG. 20** **FIG. 21** illustrates the elements previously described and in addition shows the interface of adjacent fry vats **406** and **420** and in enlarged form in **FIG. 22** Disposed between fry vats **406** and **420** is a banking strip **518** that bridges the gap between fry vats **406** and **420** Banking strip **518** can be in a shape as desired and in the illustrated embodiment is a generally inverted V-shaped strip that spans the gap between fry vats **406** and **420**. Banking strip **518** prevents any material that is discharged between fry wheels **410** and **412** from falling between fry vats **406** and **420** and causing such material to fall into one of fry vats **406** and **420**

[0222] Referring to **FIGS. 23 and 24**, there are illustrated alternate embodiments of a fry wheel for use in accordance with the invention It is to be understood that the fry wheel is capable of numerous changes and rearrangements, and the fry wheel, as well as other components and embodiments of the present invention, is not intended to be limited to the specific embodiments described herein

[0223] Referring to **FIGS. 23 and 24**, there are illustrated wire form wheels **479** and **481** Each of wheels **479** and **481** has a rim **520** and **522**, respectively, constructed of tubing, which can be smooth tubing. Such a wheel could be driven by a friction wheel, if desired In each of wheels **479** and **481** a plurality of individual tubular spokes **524** extend from each rim to a corresponding hub assembly **526** An axle **528** connects hubs **526** together in each of wheels **479** and **481** Wheel **479** includes a slotted member **530** that bridges each pair of spokes **524** Each slotted member **530** includes a centrally disposed slot **532** and a pair of tabs **534** on either side of slot **532** A plurality of fry baskets **536**, one for each slotted member **530** or pair of spokes **524** is mounted in a snap-lock relationship to each slotted member **530** Fry baskets **536** have perforated sides and a perforated bottom and top and can be of a similar configuration as previously described with respect to fry wheel **410** Each basket **536** can have a spring tab member **538** that interlocks with slotted member **530** to secure fry basket **536** to fry wheel **479** resulting in a finished fry wheel **481** as shown in **FIG. 24** It is to be understood that the embodiment illustrated in **FIGS. 23 and 24** is not limited to snap-in baskets and that other baskets can be used with the wheel arrangement depicted in **FIG. 23** with or without slotted members **530**. For example, baskets could be welded or otherwise affixed to rim **520** and spokes **524**. Each of fry baskets **536** includes perforations **540** on the sides, top and bottom thereof, such as previously described with respect to compartment forming member **438**

[0224] Referring to **FIG. 24**, there is illustrated an alternative drive mechanism **535** to rotate fry wheel **481** Drive mechanism **535** includes a motor **537**, a shaft **539** and drive rollers **541** and structure for supplying a force in the direction of arrow FW Drive rollers **541** are mounted on shaft **539** which can be rotated by motor **537** to cause rollers **541**, each aligned with one of rims **522**, to rotate, thereby rotating

fry wheel **481**. A force FW is supplied in the direction of arrow FW to ensure that rollers **541** impart a sufficient tractive force to cause rotation of fry wheel **481**. Force FW can be supplied by any suitable structure, including a spring, a weight or an electromagnet, for example. For example, motor **537**, shaft **539** and rollers **541** could be mounted on a platform (not shown) that is moveable in the direction of arrow FW and a force could be applied to urge platform in the direction of arrow FW to ensure proper traction of rollers **541**. Rollers **541** may be constructed of any suitable material, including rubber, for example. Motor **537** can be controlled by fry control **116**, for example.

[0225] Fry wheel **410** can be rotated as desired so that food deposited in one of compartments **422-436** travels through and out of the cooking oil **454** until that compartment reaches a discharge location. Thus, in the embodiment illustrated in **FIGS. 13 and 20**, the rotation is in a clockwise direction as indicated by arrow K in **FIG. 13** and arrow K in **FIG. 20**. The rotation of fry wheel **410** can be either continuous or periodic. In a periodic rotation, the rotation will typically be incremental, that is, the wheel is rotated to some degree and then stops. Thereafter, after a set period of time, the wheel undergoes another periodic rotation. This process continues as each fry basket is rotated through and out of the cooking oil vat and to the discharge location. Preferably, each periodic rotation consists of a rotation of 360° divided by the number of compartments present in the fry wheel or some fraction of that periodic rotation increment so that the position of the wheel can be known without the use of sensors. However, the use of a sensor or sensors to be able to monitor wheel position can also be used either as the primary way of controlling wheel position or as a backup. Also, use of a sensor to determine wheel position allows use of a standard AC or DC motor. Suitable control of wheel **410** can be accomplished by fry control **116**, for example.

[0226] In accordance with the present invention, a basket shaking simulation can be achieved. Basket shaking simulation can be performed by a relatively slight back and forth rotation of the fry wheel, such as fry wheel **410**. Thus, the drive mechanism is activated to rotate the fry wheel clockwise and counterclockwise through a relatively small degree of angular rotation to simulate shaking of a fry basket during frying. The back and forth rotation can occur relatively rapidly and typically the degree of angular rotation will be in the range of from about 2 to about 20 degrees. In addition, the periodic rotation in one direction may be of a larger angle of rotation than the rotation in the other direction.

[0227] Preferably, the degree of rotation during simulated basket shaking will be monitored, particularly where the rotation in one direction is greater than the rotation in the other direction so that the position of each basket relative to the discharge location can be monitored by the control system to ensure proper discharge of food from food compartments.

[0228] Referring to **FIG. 64**, there is illustrated in partially schematic view fry device **400** along with portions of food dispensing device **200** and food packaging device **600**. As illustrated in **FIG. 64** a hood system **546** is provided. Hood system **538** includes a hood structure **548**, a filter **542** and a drip pan **544**.

[0229] A suitable air blower (not shown) can be provided to cause air flow to move within hood system **538** generally in the direction of arrows A1, A2 and A3. Filter **542** thus filters particulate matter in air flow A1 that passes through filter **542**. Drip pan **544** catches any matter that drips from filter **542** that is located above drip pan **544**. Preferably, hood system **538** substantially completely encloses the area above fry device **400** to reduce waste discharge into the operating environment of automated food processing system **100**.

[0230] Food Packaging Device

[0231] Referring to the Figures generally, and in particular to **FIGS. 1 and 25-50**, there is illustrated various embodiments of food packaging devices and elements thereof in accordance with the invention.

[0232] In one embodiment, food packaging device **600** is illustrated or partially illustrated and elements useful in connection with food packaging device **600** are illustrated in **FIGS. 1 and 25-50**. Food packaging device **600** includes a cabinet **602** having a countertop surface **636**. Food packaging device **600** can be advantageously constructed in modular form so that it can be operated together with previously described food dispensing device **200** and fry device **400** and alternatively operated separately from both or either of those devices.

[0233] Food packaging device **600** in the illustrated embodiment includes a food inlet chute **604**, rotatable food dispensing member **606**, food dispensing chute mechanism **608**, automated container handling system **610**, container-receiving receptacle **612**, overflow food collection member **613**, conveyor system **614**, waste chute **615**, food seasoning system **616** and raceway **620**.

[0234] In the illustrated embodiment, food packaging device **600** includes a container storage device for containing cartons or containers of various sizes. During operation of packaging device **600**, the device selects a container of a desired size from container storage magazine **638**, erects the container into an erected form that is unerected while contained in storage magazine **638** and then positions the erected container to receive food dispensed from food dispensing chute mechanism **608**. After receiving food from food dispensing chute mechanism **608**, automated container handling device **610** is capable of moving the filled or partially filled container to container receiving receptacle **612** which is transported via conveyor system **614** to a desired location for subsequent pickup of the container by a human operator, for example.

[0235] In the embodiment illustrated in **FIGS. 25-29**, food packaging device **600** includes food overflow collection member **613** to collect food dispensed by food dispensing chute mechanism **608** that is not deposited into a container. In the illustrated embodiment, overflow food collection device **613** is a rotatable wheel as hereinafter described in detail. Overflow food collection member **613** functions to collect food dispensed by food dispensing chute mechanism **608** that is not received in a container and to recycle that food into food dispensing chute mechanism **608** for subsequent dispensing to a container. This permits food dispensed by food dispensing chute mechanism **608** but not deposited in a container to be promptly recycled to the dispensing chute in a first-in, first-out manner, so that overflow food is promptly recycled and dispensed to a container.

[0236] Referring to **FIGS. 26-28**, there is illustrated food packaging device **600** in which inlet chute **604** is positioned

to receive food, in this case French fries, from food dispensing lanes **234**, **236** and **238** of dispensing device **200**, which food has been subsequently fried after dispensing in fry wheels **410**, **412** and **414** of fry device **400** After frying in any of wheels **410**, **412** and **414** of fry device **400**, food dispensed therefrom enters inlet chute **604**, as illustrated in **FIGS. 3 and 28**, for example In inlet chute **604** the food travels downwardly along chute **604** and into rotatable food dispensing member **606** in the direction of arrow M of **FIG. 28** and arrow E of **FIG. 3** Inlet chute **604** can be configured as desired and may be configured to accept the product from any one or all of fry wheels **404**, **410**, **412** and **414** In **FIGS. 25-27**, a holding area **607** receives product from fry wheel **404** for manual packaging A manual or automated diverter bar **605** can optionally be provided as shown in **FIG. 27** to divert French fries from device **600** to permit filling unsalted fry orders Bar **605** can be moved between open and closed positions as indicated by arrow Z, such as by a cylinder (not shown)

[0237] Rotatable food dispensing member **606** in the illustrated embodiment is a dispensing wheel that is mounted for rotation in dispensing device **600** Dispensing member **606** has a plurality of food containing compartments **640** that are arrayed around the periphery of rotatable food dispensing member **606** Each of compartments **640** is divided from another compartment by a compartment wall **642** Preferably, each compartment wall **642** is not normal to peripheral edge **644** of rotatable food dispensing member **606** but at a slight angle such as, for example, as illustrated in **FIG. 29** and **FIG. 61**

[0238] Wheel **606** includes a pair of opposed rim portions **646***a* and **646***b* and a circular ring portion **648** that interconnects opposed rims **646***a* and **646***b* Circular ring **648** is disposed close to the peripheral edges of rims **646***a* and **646***b* and defines peripheral edge **644** Preferably, circular ring **648** is constructed of a perforated metal material so that circular rims **646***a* and **646***b* have perforations **650** therethrough as illustrated in **FIG. 28**, for example

[0239] In accordance with the illustrated embodiment, rotatable dispensing member **606** is configured as a rotatable wheel although other embodiments are within the scope of the invention For example, a rotatable dispensing member in accordance with the invention could be a portion of a wheel, such as a semicircular or other configuration

[0240] In the illustrated embodiment, rotatable food dispensing member **606** is rotated by a drive mechanism **652** Drive mechanism **652** consists of a motor **654** that drives a drive wheel **656** Drive mechanism **652** is controlled by a suitable control mechanism to cause rotation of drive wheel **656** and hence rotatable food dispensing member **606** in a desired direction and at a desired rate of speed Drive wheel **656** can be a pressure roller or alternatively can be a drive wheel like or similar to drive wheel **468** previously described with respect to **FIG. 14** Rotatable food dispensing member **606** can be driven via one or both of opposed rims **646***a* and **646***b* Alternatively, and as illustrated in **FIG. 28**, rotatable food dispensing member **606** is driven through a drive rim **658** Each of rotatable food dispensing members **606** and overflow food collection member **613** rest on spaced apart rollers **660** and **662** Each of rollers **660** and **662** are constructed to bear the weight of rotatable food dispensing member **606** and overflow food collection member **613** and have a length that spans both Alternatively, separate rollers or some other supporting structure could be used to support rotatable food dispensing member **606** and overflow food collection member **613** An inner curved fender or baffle member **664** as illustrated in **FIG. 29** is provided to ensure that food contained in compartment **640** of rotatable food dispensing member **606** does not prematurely discharge Preferably, fender **664** follows the inner curvature of rotatable food dispensing member **606** and has perforations **666**, which can be similar to perforations **650** of circular ring **648** Fender **664** is suitably mounted so that it is stationary relative to rotatable food dispensing member **606** A similar fender could also be provided for overflow food collection member **613**, if desired (not shown)

[0241] Referring to **FIG. 61**, there is illustrated an elevation view of a portion of rotatable food dispensing member **606** which is typically rotated in the direction of arrow Y when viewed from the front of food packaging device **600** Fender **664** prevents food, in this case French fries FF, from falling from compartments **640** prematurely

[0242] Overflow food collection member **613** is configured to collect food deposited from food dispensing chute mechanism **608** that is intended to be received into container **611** when held in position to receive food from food dispensing chute mechanism **608** which food does not stay in container **611** This can occur since oftentimes it is desirable to overfill container **611** so that food is mounded up above the top surface of container **611** Also, for food such as French fries, such food material fills container **611** somewhat randomly and it is typical for French fries to dangle over the sides of container **611** In the illustrated embodiment, overflow food collection member **613** is configured in a manner similar to rotatable food dispensing member **606** previously described Thus, food collection member **613** includes opposed rims **668***a* and **668***b* and circular ring **670** having perforations **672** Circular ring **670** connects opposed rims **668***a* and **668***b* in a manner as previously described with respect to member **606** In addition, food collection member **613** has a plurality of inner compartments that are similar in construction to compartment **640** previously described with respect to member **606** Member **613** also has a drive rim **674** and is driven by a drive mechanism **676** that is similar to drive mechanism **652** previously described including a drive wheel **676'** and a motor **678** Drive mechanism **676** is configured to rotate food collection member **613** in either a clockwise or counterclockwise direction as hereinafter described in more detail

[0243] Food collection member **613** also includes a plurality of compartment walls **680** that are similar to compartment walls **642** previously described with respect to rotatable food dispensing member **606**, providing a plurality of food containing compartments **682**

[0244] Each of food dispensing member **606** and food collection member **613** has bottom portions that are disposed through an opening **684** in countertop surface **636** of cabinet **602** The construction of the illustrated embodiment permits food dispensing member **606** and overflow food collection member **613** to be readily removed from food packaging device **600** such as for cleaning and/or repair

[0245] A heating system as described can be incorporated into food packaging device **600** to supply heat to food contained therein For example, a heating system **681** can be

provided, which is illustrated in FIG. 29 Heating system 681 includes a heating device 683 having a heating element 685, located above dispenser 606 as desired Heating devices 687 and 689 may also be included within dispenser 606 and/or 613 as desired The heating devices may comprise radiant heaters and can be ceramic heaters, for example Any suitable type of heating device or system can be used in accordance with the invention Heating system 681 can be controlled by packaging control 118, for example In addition, a heating device can be provided to direct heat to food container pick up location 622, if desired to keep food contained thereat warm

[0246] Referring to FIGS. 1, 3, 25-26, 28-29 and 43-44, various aspects of the configuration and operation of food dispensing chute mechanism 608 are illustrated and will be described Food dispensing chute mechanism 608 includes an upper chute 686, a lower chute 688, a chute support member 690, a connecting link 692, a stop member 694, a rotatable link 696 connecting stop member 694 to chute support member 690, a rotatable link 698 connecting upper chute 686 to support member 690, a cylinder 700 for operating food dispensing chute mechanism 608, a load cell 702 for weighing the contents of food contained in food dispensing chute mechanism 608 and a rotatable link 704 connecting cylinder rod 706 to upper chute 686

[0247] Upper chute 686 preferably and as illustrated in the referenced figures, forms part of food dispensing chute mechanism 608, and has an inlet location 708 for receiving food dispensed from rotatable food dispensing member 606 and a discharge location 710 for dispensing food contained in food dispensing chute mechanism 608 and into a container, such as container 611 as illustrated in FIG. 43, for example

[0248] Upper chute 686 of food dispensing chute mechanism 608 is positioned to receive pieces of food from a discharge location 712 of rotatable food dispensing member 606. Upper chute 686 has a food holding area 714 for holding food received from rotatable food dispensing member 606 A weighing device is associated with food dispensing chute mechanism 608 so that the amount of food contained therein, such as in food holding area 714, can be determined Any suitable device can be utilized to determine the amount of food contained in food dispensing chute mechanism 608 In the illustrated embodiment, a load cell 702 is provided to determine the weight of food contained in food dispensing chute mechanism 608 and is illustrated schematically in FIGS. 43 and 44, for example

[0249] FIG. 44 illustrates food dispensing chute mechanism 608 in the upper position ready to receive food from rotatable food dispensing member 606 In that configuration, cylinder 700 is retracted and upper chute 686 is generally horizontal This configuration allows a quantity of food to be dispensed into upper chute 686 and into food holding area 714 without being dispensed therefrom When a sufficient quantity of food is deposited in upper chute 686, such as French fries FF, as determined by load cell 702 which communicates with the control system of food packaging device 600, the food contained therein is ready to be dispensed Typically, the amount of food contained in chute 686 will be sufficient to adequately fill container 611 Since container 611 is of a known size, rotatable food dispensing member 606 can be operated to supply food to chute 686 until a desired quantity is contained therein for dispensing to container 611

[0250] To dispense food from food dispensing chute mechanism 608, cylinder 700 is activated to extend cylinder rod 706 upwardly thereby causing upper chute 686 to drop Since lower chute 688 is connected to upper chute 686 via connecting link 692, lower chute 688 also drops to the discharge position as illustrated in FIG. 43 which movement is indicated by arrow S Stop 694 which is connected to lower chute 688 and pivotally mounted via rotatable link 696 to chute support member 690, engages chute support member 690 as illustrated in FIG. 43 and prevents further downward movement of upper chute 686 and lower chute 688 In addition, stop member 694 engaging chute support member 690 defines the lowermost position of upper chute 686 and lower chute 688 which is also the dispensing position of food dispensing chute mechanism 608, as illustrated in FIG. 43 This position also provides discharge location 710 of dispensing chute mechanism 608

[0251] Referring to FIGS. 25-28, there is illustrated container storage magazine 638, which can form part of food packaging device 600 Container storage magazine 638 is configured to store a plurality of different sized food containers in an unerected form Typically, container storage magazine 638 will be configured to hold a variety of different sized containers In the illustrated embodiment, container storage magazine 638 can contain four different sizes of French fry containers or cartons Container storage magazine 638 includes a base 716 that is suitably mounted with mounting structure 718 to cabinet 602 Preferably, mounting structure 718 permits container storage magazine 638 to be readily removed to permit access to rotatable food dispensing member 606 and overflow food collection member 613

[0252] Base 716 typically can be in the form of a base plate and includes four apertures 720, 722, 724 and 726, each of said apertures corresponding to the profile of a different size collapsed carton. Apertures 720, 722, 724 and 726 are dimensioned to be able to retain a stack of cartons in a collapsed or unerected condition as illustrated in FIG. 25 in which a plurality of unerected cartons 728 are stacked therein

[0253] Each aperture 720, 722, 724 and 726 and base 716 has associated therewith a plurality of guide members 730-760 In the illustrated embodiment, guides 730-760 are in the form of post or tubular-type members Each set of four guide members is associated with a specific one of apertures 720, 722, 724 and 726 to define and permit stacking of a plurality of unerected French fry cartons or containers that generally correspond in size to the size of apertures 720, 722, 724 and 726, respectively It is to be understood that other arrangements to define a container stack can be utilized in accordance with the invention For example, in place of guides 730-760 other structure could be utilized, such as upstanding walls or partial walls or other types of guides

[0254] Container storage magazine 638 may also include a suitable removable cover (not shown) to enclose base 716 and the volume defined over apertures 720-726 by guides 730-760

[0255] Container storage magazine 638 is preferably positioned to permit ready access to the bottom of each container

stack through the bottom of each of apertures 720-726 by automated container handling system 610, which is hereinafter described in detail

[0256] Food packaging device 600 includes automated container handling system 610. Automated container handling system 610 is capable of retrieving an unerected container through any of apertures 720, 722, 724 and 726 of unerected container storage magazine 638, erecting the unerected carton, holding the erected carton in position at discharge location 710 of food dispensing chute mechanism 608 and depositing the filled container onto conveyor system 614, which conveyor system 614 subsequently transports the filled container to a desired location

[0257] Referring to FIGS. 1, 25, 27-28 and 30-44, there is illustrated automated container handling system 610 and elements and features thereof. Automated container handling system 610 includes a container retrieving and grasping device 762, a container grasping device 764 and a container bottom urging device 766

[0258] Automated container handling system 610 is controlled by a suitable control system for food packaging device 600

[0259] Container retrieving and grasping device 762 and portions thereof are best illustrated in FIGS. 30-39. Container retrieving and grasping device 762 includes a mast 768, which is mounted to a carriage system 770, a moveable rack member 772, a pinion 774, a frame 776, a container grasping member 778 and a linkage assembly 780

[0260] Mast 768 is carried by carriage system 770 which carriage system 770 allows for lateral translation of mast 768 and the components associated therewith, including moveable rack member 772, pinion 774, frame 776, container grasping member 778 and linkage assembly 780. Carriage system 770 includes a guide member 782, a worm gear 784, a drive mechanism 786 and a carriage follower 788. Carriage follower 788 supports a vertical translation mechanism 790 that, in turn, carries mast 768

[0261] Carriage guide 782 is an elongated guide that defines the lateral translation movement direction of carriage follower 788 and is secured within cabinet 602. Worm gear 784 is disposed parallel to carriage guide 782 and when rotated moves carriage follower 788 along carriage guide 782.

[0262] Worm gear 784 is driven by drive mechanism 786 which can include a drive motor 792, a drive gear or pulley 794 and a driven gear or pulley 796. Where drive and driven pulleys are used, typically a belt 798 will impart rotation from one pulley to another.

[0263] Drive motor 792 causes worm gear 784 which is mounted for rotation and which is rotated by rotation of driven pulley or gear 796 in either direction. Drive motor 792 can be an AC or DC motor or a stepper or servo motor as desired. Suitable sensors can be employed (not shown) to determine the position of carriage follower 788 which determines the lateral position of container grasping member 778

[0264] Carriage follower 788 is composed of a frame 800 having a guide aperture or slot 802 in which carriage guide 782 is disposed and a threaded aperture or slot 804 in which elongated worm gear 784 is disposed to impart lateral motion to carriage follower 788 by rotation of worm gear 784. Thus, carriage system 770 provides lateral movement in the direction of arrows Q as shown in FIG. 39. In this manner, carriage follower and thus mast 768 can be laterally translated as desired

[0265] A suitable opening 806 is located in countertop surface 636 of cabinet 602 to permit mast 768 to extend therethrough.

[0266] Mast 768 can be raised and lowered in a vertical direction as indicated by arrow V in FIG. 39

[0267] Mast 768 can be vertically raised and lowered in the directions indicated by arrow V in FIG. 39 by operation of a drive mechanism 810 that forms part of vertical translation mechanism 790. Vertical translation mechanism 790 is a vertically extending carriage system similar to that described with respect to carriage system 770 and includes a drive mechanism 810 which is composed of a motor 812 which is carried by carriage follower 788, a vertically disposed carriage guide 814, a vertically disposed worm gear 816 which is driven in a suitable manner by motor 812 such as previously described with respect to drive mechanism 786 of carriage system 770, which can be controlled in a similar manner. Vertical translation mechanism 790 also includes a vertical carriage follower 818 having a threaded aperture or slot and a guide aperture or slot (not shown) which vertical carriage follower 818 is secured to mast 768

[0268] Mast 768 has mounted thereto frame 776, typically at an upper end thereof. Linkage assembly 780 is secured to frame 776 as well as pinion 774 and moveable rack member 772

[0269] Moveable rack member 772 includes a frame 820 having a guide slot 822 vertically disposed therein and a rack 824 which meshes with pinion 774. Moveable rack member 772 may also include extra mass in the form of a weight block 826 to help urge moveable rack member downwardly when not restrained

[0270] A pair of guides 828 and 830 are rigidly secured to frame 776 and are disposed within slot 822 of moveable rack 772. A spring 832 can be connected between an upper end of moveable rack member 772 and guide 828 or 830 to urge moveable rack member 772 to a lower position as illustrated in FIG. 30 compared with the upper position as illustrated in FIGS. 34-37.

[0271] In a preferred embodiment, moveable rack member 772 includes a stop 834 which stop can be vertically adjustable. While stop 834 is located at the bottom of moveable rack member 772 it is to be understood that a stop could be provided at another location provided that a suitable engaging surface at a proper location is provided

[0272] Mounted to frame 776 is an axle 836 that is mounted for rotation relative to frame 776. Axle 836 has pinion gear 774 rigidly secured thereto as well as one end 838 of linkage 780. The other end 840' of linkage 780 is securely mounted to frame 776 as illustrated in FIGS. 30-37, for example

[0273] Linkage 780 which carries container grasping member 778 is composed of a plurality of links so that container grasping member 778 is moveable from a horizontal position as illustrated in FIGS. 30-32 to a vertical position as illustrated in FIGS. 34-37. When container

grasping member **778** is in the horizontal position it is utilized to grasp and retrieve a desired size of container from one of the apertures **720**, **722**, **724** and **726** from container storage magazine **638** For this purpose, container grasping member **778** includes a suction cup device **840** which includes at least one suction cup **842** and in the illustrated embodiment two suction cups **842** and **844** arrayed in substantially the same plane for grasping a container having a surface to be grasped by both suction cups **842** and **844** in the same plane Suction cup device **840** also includes a vacuum source **846**, a release valve **848** and a suitable vacuum line **850** which connects suction cups **842** and **844** to vacuum source **846**, as illustrated in **FIG. 30**, for example In operation, when suction cups **842** and/or **844** engage a container or other member to be grasped, vacuum source **846** is activated to supply vacuum to suction cups **842** and **844**, such as to grasp and retain a container from one of apertures **720**, **722**, **724** and **726** of container storage magazine **638**

[0274] Linkage assembly **780** includes, in the illustrated embodiment, a first link **852**, a second link **854** and third link **856**

[0275] First link **852** is rigidly secure to axle **836** and pinion **774** First link **852** is configured in an L-shape with the end of first link **852** opposite the portion connected to axle **836** pivotally connected to second link **854** having one end being pivotally connected to first link **852** via pivot connection **858**

[0276] Second link **854** is connected to third link **856** via a universal joint connection **860** a location spaced apart from pivot connection **858** as illustrated in, for example, **FIGS. 30-37** Section cups **842** and **844** are mounted to second link **854** An offset member **862** which depends from second link **854** provides a desired offset for universal joint connection **860** which connects second link **854** to third link **856**

[0277] Third link **856** is, in turn, connected to frame **776** via a universal joint connection **864** which is at a distance removed from universal joint connection **860** which connects third link **856** to second link **854** An offset member assembly **866** is rigidly secured to frame **776** and includes an angled block **868** and an offset extension **870** to provide the desired angled and clearance for universal joint **864** and third link **856**

[0278] In operation, when moveable rack member **772** is moved relative to mast **768**, such as when stop **834** contacts a surface, such as in the illustrated embodiment, countertop surface **636** as illustrated in **FIG. 36**, continued downward vertical movement of mast **768** causes rack member **772** to move upwardly relative to mast **768** This causes rotation of pinion **774** which meshes with rack **824** mounted to rack member **772**. Rotation of pinion **774** in a counter-clockwise direction in **FIG. 30** causes rotation of first link **852** Such rotation causes downward movement of that portion of first link **852** that is pivotally connected to second link **854** via pivot connection **858** Such movement, in turn, causes second link **854** to pivot upwardly about pivot connection **858** in a clockwise direction as viewed in **FIG. 30** to cause suction cups **842** and **844** to move to a vertically oriented position as depicted in **FIGS. 34-37** from the horizontally oriented position depicted in **FIGS. 30-33** In addition, such movement of first link **852** causes movement in rotation of third link **856** and universal joint connection **860** and **864** to the position indicated in **FIGS. 34-37** When container grasping member **778** is in the position indicated in **FIGS. 34-37**, an unerected container held by suction cups **842** and/or **844** will be vertically oriented when suction cups **842** and/or **844** are attached to the container sidewall, as illustrated in **FIG. 40**, for example

[0279] In a typical operation, container retrieving and grasping device **762** will be operated to position suction cups **842** and **844** below a container to be selected from container storage magazine **638** Mast **768** will be raised by operation of vertical translation mechanism **790** to a desired height so that suction cups **842** and **844** engage a container contained at the bottom of container storage magazine **638** Vacuum source **846** is activated and mast **768** can be lowered to remove a container from a desired one of apertures **720**, **722**, **724** and **726** of container storage magazine **638**. Carriage system **770** can be activated to move container retrieving and grasping device **762** laterally to a desired location Such lateral movement can be controlled by properly positioned sensors **872**, **874**, **876**, **878** and **880**, for example For example, sensor **872** can define the position to retrieve a container from aperture **720**, sensor **876** to retrieve a container from aperture **722**, sensor **878** to retrieve a container from aperture **724** and sensor **880** to retrieve from aperture **726** Sensor **874** can be positioned to define the proper location of container grasping member **778** to erect the container that has been retrieved from one of apertures **720**, **722**, **724** or **726** of container storage magazine **638**, as hereafter described After erecting the container, the vacuum applied to suction cups **842** and **844** is released by operation of release valve **848** which permits suction cups **842** and **844** to disengage and release the container that had been grasped Mast **768** can then be raised causing stop **834** to be removed from countertop surface **636** and by action of weight **826** and operationally spring **832**, causing rack member **772** to move downwardly relative to mast **768** thereby rotating pinion gear **774** clockwise relative to the position shown in **FIG. 34**, thereby moving linkage assembly **780** to cause movement of container grasping member **778** from the position illustrated in **FIGS. 34-37** to the position indicated in **FIGS. 30-33**, where container grasping member **778** is in position to retrieve a desired carton from container storage magazine **638** in a manner previously described, which includes lateral translation of container grasping member **778** by carriage system **770**

[0280] It is to be understood that any suitable automated device or system for retrieving, grasping and moving a container to a desired location as desired herein can be utilized in accordance with various aspects of the present invention Thus, various aspects of the present invention are not limited by the particular embodiment of container retrieving and grasping device **762** and components thereof described herein For example, an automated or robotic arm could be utilized to select, grasp and retrieve erected or unerected containers from a source as desired and then erect the carton or container in a suitable manner, followed by holding the erected container at dispensing location **710** and after filling placing the filled container, such as container **611** on to a suitable conveyor to move the filled container to a desired location

[0281] Container grasping device **764** of container retrieving and grasping device **762** will now be described, and in particular with reference to **FIGS. 38 and 40-44**

[0282] Container grasping device **764** includes a rotatable and vertically translatable mast **884**. Mast **884** can be rotated as illustrated by arrow P in **FIG. 38** and vertically translated up and down as indicated by arrow **0** also in **FIG. 38**. Mast **884** is connected to a shaft **886** via a slot and key arrangement between mast **884** and shaft **886** permitting mast **884** to be rotated by shaft **886** which, in turn, can be rotated by a step or motor **890** or other suitable motor or device to rotate shaft **886** a desired degree. Motor **890** drives a drive pulley or gear **892** which, in turn, drives a driven pulley or gear **894**. In the case where pulleys are utilized, a belt **896** is used to transmit rotation from pulley **892** to pulley **894**. Motor **890** can be a stepper router or a servo motor as desired. Alternatively, an AC or DC motor can be utilized provided that a suitable control is provided so that the orientation of mast **884** can be determined. A carriage system **898** is utilized to provide the desired vertical movement of mast **884** in up and down directions. Carriage system **898** is similar to carriage system **770** previously described and includes a carriage guide **900**, a worm gear **902**, a carriage follower **904**, a drive mechanism **906** which includes a motor **908** (which can be a servo motor or an AC or DC motor) suitably controlled to drive or gear **902**. Carriage follower **904** includes a threaded aperture or slot **910** which communicates with worm gear **902** and a threaded aperture or slot **912** in which guide **900** is disposed. A carriage follower interface **914** connects carriage follower **904** to mast **884** and permits shaft **886** to rotate with respect to carriage follower interface **914**. Thus, in operation, rotation of motor **908** rotates worm gear **902** thereby translating carriage follower **904** up or down depending on the direction of rotation. A suitable sensor (not shown) can be employed to determine the height of mast **884** for control by control system **118** for packaging device **600**.

[0283] Suitable mounting structure **916** is provided to mount container grasping device **764** to a desired location, such as within cabinet **602**. A slot and key arrangement between shaft **886** and mast **884** permits **884** mast to be vertically translated either up or down while shaft **886** is rotated.

[0284] Mounted on the upper end of mast **884** is a suction device **918** which includes a suction cup **920**, a source of vacuum (not shown) for suction cup **920** and a release valve (not shown) for releasing the vacuum to suction cup **920**. Vacuum can be supplied from within mast **884** to suction cup **920** by a suitable connection as is known in the art.

[0285] Container bottom urging device **766** consists of a mast **922** that is vertically translatable up and down by suitable apparatus (not shown). Such apparatus can be similar to vertical translation mechanism **790** previously described with respect to container retrieving and grasping device **762**. Preferably, mast **922** has a blunt end **924**.

[0286] In operation, container retrieving and grasping device **762** selects an appropriately sized container from container storage magazine **638** as directed by the control system for food packaging device **600**. After retrieving the container, which in this case is container **611**, container retrieving and grasping device **762** moves container **611** to a position as indicated in **FIG. 40** against suction cup **920** so that opposed sidewalls of container **611** are grasped by suction cups **840** and **842** of container grasping member **778**.

[0287] Next, as shown in **FIG. 41**, container grasping member **778** is moved laterally away from suction cup **920** while maintaining suction on suction cups **840, 842** and **920**. Container **611** is partially erected as shown in **FIG. 41** with bottom **611***b* depending downwardly slightly. Container bottom urging device **766** is then activated as illustrated in **FIG. 42** to urge bottom **611***b* of container **611** upwardly into the fully erected position. Container grasping member **778** is released and retracted from container **611** and returned to a horizontal up position to select another unerected container for erection.

[0288] Next, mast **884** is rotated approximately 90° by motor **890** to place container **611** in discharge position **710** of food dispensing chute mechanism **608**. Food dispensing chute mechanism **608** is then lowered to discharge French fries FF therefrom and into container **611**. Any French fries that are not received into container **611** are collected by overflow food collection member **613** which is then rotated clockwise in the direction of arrow X as shown in **FIG. 41** to recycle such French fries to upper chute **686** for subsequent delivery to another container. After the French fries are dispensed from food dispensing chute mechanism **608**, cylinder **700** is retracted placing food dispensing chute mechanism **608** in the upper position as shown in **FIG. 44**. Mast **884** can then be rotated back and forth slightly (e.g., such as 20 to 200, for example) to simulate shaking to dislodge any loose French fries or dangling French fries in container **611** and any dislodged French fries will then fall into overflow food collection member **613** for subsequent recycling. Mast **884** can also be raised and lowered slightly and relatively quickly either before, during or after the angular rotation to further simulate shaking. Thereafter, mast **884** is rotated approximately 180° until container **611** is directly over container-receiving receptacle **612** as indicated by T in **FIG. 44**. Mast **884** is then lowered by operation of carriage system **898** until the bottom of container **611** rests in container-receiving receptacle **612**. Then, the vacuum supplied to suction cup **920** is released and suction cup **920** releases from container **611**. Mast **884** can then be rotated 90° so that it is in position to receive another container to be erected.

[0289] Container-receiving receptacle **612** is then transported via conveyor system **614** which will now be described in detail.

[0290] Conveyor system **614** and portions or elements thereof are illustrated in various figures including FIGS. **1, 25-29** and **45-50**.

[0291] Conveyor **614** includes, in the illustrated embodiment, raceway **620** which can be formed along the surface of countertop **636** or on some other surface as desired. Raceway **620** is preferably in the form of a continuous loop raceway and is defined by spaced apart guides **620***a* and **620***b* mounted to countertop **636** to guide receptacles **612**. Conveyor system **614** includes one or more and typically a plurality of container-receiving receptacles **612** which are illustrated in detail in **FIGS. 46-50**. Gate structure **634** of conveyor system **614** includes a first gate **926** and second gate **928**. First gate **926** is moveable and typically second gate **928** can be stationary as hereinafter described.

[0292] Conveyor system **614** also includes structure for causing movement of container-receiving receptacle **612**. In the illustrated embodiment, container-receiving receptacles **612** are moved via an endless loop **930** that can be located beneath countertop **636**. Endless loop **930** carries a plurality

of magnets **932** as illustrated in **FIGS. 45 and 49**, for example. Magnets **932** are spaced along endless loop **930**. Endless loop **930** may comprise a chain or other suitable structure that can be driven by a drive system that includes sprockets **934, 936, 938** and **940**. One of sprockets **934, 936, 938** and **940** can be a driven sprocket.

[0293] Any suitable endless loop **930** can be utilized such as a belt or a chain. Pulleys could be used in place of sprockets **934-940**. The route of endless loop **930** follows the route of raceway **620**.

[0294] Container-receiving receptacle **612** typically includes a base **942** and a container-receiving well **944** located over base **942**. Base **942** includes an enclosed compartment **946** which can be conveniently accessed by a base plate **948** located along the bottom of base **942** that is fastened to base **942** by suitable fasteners **950**. Contained within enclosed compartment **946** is a magnet **952**.

[0295] Container-receiving receptacle **612** follows the movement of magnet **932** due to magnetic attraction between magnets **932** and **952** thereby causing movement of container-receiving receptacle **612** along raceway **620**.

[0296] Enclosed compartment **946** is dimensioned to permit magnet **952** to be free to rotate therein allowing container-receiving receptacle **612** to be readily guided by rails **954** and **956** that are raised above countertop **636**.

[0297] Movable gate **926** prevents movement of container-receiving receptacle **612** located thereat as illustrated in **FIG. 45**. This ensures that container-receiving receptacle **612** is in position to receive a loaded container of French fries, such as container **611** from container grasping device **764**. After a filled container is placed on container-receiving receptacle **612** adjacent moveable gate **926**, gate **926** is automatically removed by a suitable mechanism (not shown) to permit container-receiving receptacle **612** thereat to be moved by conveyor system **614** until French fry container **611** contained therein contacts gate **928** or receptacle **612** contacts another receptacle that is located at pick up area **622** as shown in **FIG. 45**. Once container **611** is moved from receptacle **612***b*, receptacle **612***b* is then free to move along raceway **620** and passes underneath second gate **928**, which can be a stationary gate. Alternatively, second gate **928** could be a moveable gate and could be located at a level that directly prevents movement of receptacle **612***b*. After receptacle **612***b* passes underneath second gate **928**, receptacle **612***a* is moved into the position formerly occupied by receptacle **612***b* provided that receptacle **612***a* has a French fry container thereon which would then cause receptacle **612***a* to be stopped at gate **928**. Similarly, when that container is removed from receptacle **612***a*, receptacle **612***a* would then be free to pass underneath gate **928** and around that portion of raceway **620** until encountering gate **926** or another receptacle that is stopped by gate **926**.

[0298] Referring to **FIGS. 51-60**, there is illustrated various views of French fry cartons that are useful in accordance with the present invention. The French fry cartons depicted in **FIGS. 51-60** are particularly suitable for use in conjunction with the present invention since the cartons readily stand upright without assistance and can be erected by automated container handling system **610**, previously described.

[0299] **FIG. 51** illustrates a front elevation view of a carton **1012** that is particularly suitable for containing French fries, for example. Carton **1012** is illustrated in **FIG. 51** in an erected or opened position and includes a pair of opposed curved sidewalls **1014** and **1016** and a bottom panel **1018**.

[0300] Carton **1012** can be stacked in a collapsed configuration and stored in a suitable magazine, such as container storage magazine **638** as previously described. When in a collapsed position, carton **1012** is particularly suited to being opened or erected by pulling sidewalls **1014** and **1016** apart and urging bottom panel **1018** upwardly, as described with respect to the erection or opening of container **611** by automated container handling system **610**. Container or carton **611** is of a design that is similar to carton **1012**.

[0301] Carton **1012** also includes two supporting legs **1020, 1022** that extend downwardly from the lower portions of the overlapping edge portions of sidewall **1014** indicated by reference numerals **1014***a* and **1014***b* in **FIG. 59** and **FIG. 53**.

[0302] Carton **1012** is capable of standing on its own because of legs **1020** and **1022** that extend below bottom panel **1018** when carton **1012** is open or erected.

[0303] Carton **1012** can be constructed from a single blank of paperboard which is illustrated in **FIG. 59**. When constructed, sidewall edge portions **1014***a* and **1014***b* form flaps that are glued to the edges of sidewall **1016** as indicated in **FIG. 54**, for example.

[0304] Bottom panel **1018** is specially configured to facilitate opening or erection of carton **1012** by an automated carton handling device such as automated container handling system **610**, previously described in detail. Bottom panel **1018** includes intersecting lines **1024** and **1026**. Intersecting lines **1024** and **1026** intersect at a generally central location of bottom panel **1014**, which panel is generally oval even though it may incorporate straight edges **1028** and **1030**, for example. Intersecting lines **1024** and **1026** may be fold lines, lines of weakening, score lines or even perforations. All such structures are referred to herein with respect to intersecting lines **1024** and **1026** of bottom panel **1018** only as "fold lines." Typically, the intersection of fold lines **1024** and **1026** form an angle in the range of from about 60° and about 120°. In one embodiment, the intersecting bottom panel fold lines are oriented such that one of said lines (fold line **1024** in **FIG. 59**) is normal or at least generally normal to curved sidewalls **1014** and **1016**. In such embodiment, the other of the intersecting fold lines (in this case fold line **1026**) is at least generally parallel to curved sidewalls **1014** and **1016**.

[0305] Preferably, fold line **1024** extends from sidewall **1014** to sidewall **1016**.

[0306] As previously mentioned, carton **1012** is foldable to a collapsed position with sidewalls **1014** and **1016** being planar and in contacting overlying relation to each other with bottom panel **1018** being divided into two overlying panels **1018***a* and **1018***b* by intersecting fold line **1026**.

[0307] Preferably, bottom panel **1018** includes two additional fold lines **1032** and **1034** on either side of fold line **1024** that extends from one carton sidewall to the other, in this case from sidewall **1014** to sidewall **1016**. Secondary fold lines **1032** and **1034** further facilitate the opening or

erection of container **1012** with an automated device such as automated container handling system **610**

[0308] **FIG. 58** illustrates a carton **1036** that is similar in construction to carton **1012** previously described except that carton **1036** is of a different size Preferably, carton **1012** is configured such that the width of the base is relatively narrow and the sidewalls **1014** and **1016** flare outwardly so that container **1012** is substantially wider at the top (from about 1 6 to 2 or more times the base width) This allows relatively large and tall containers to be placed in an automobile cup holder CH as depicted in **FIG. 56**

[0309] Referring to **FIG. 2**, there is illustrated an alternate embodiment of an automated food processing system **101** in accordance with the invention Automated food processing system **101** includes a food dispensing device **201** which is similar to food dispensing **200**, previously briefly described, where like reference numerals represent like elements Food dispensing device **201** includes fewer uncooked bulk food dispensing containers **204** and additional magazine food dispensers that are similar to magazine food dispenser **206**, previously referred to Otherwise, dispensing device **201** is similar to dispensing device **200** previously described

[0310] Automated food processing system **101** also includes fry device **400** which has been described

[0311] One primary distinction between automated food processing system **100** and automated food processing system **101** is that automated food processing system **101** does not include an automated packaging device such as automated packaging device **600** In place of food packaging device **600**, a food storage device **635** is provided Food storage device **635** allows food cooked by food frying device **400** to be stored in a heated environment for subsequent manual processing As configured in **FIG. 2**, food storage device **635** includes separate product receiving receptacles **637, 639, 641** and **643** Each receptacle **637, 639, 641** and **643** is dedicated to receiving food from a respective one of fry wheels **410, 412, 414** and **404**, respectively. In addition, each receptacle **637-643** can have placed therein a suitable container to receive food, such as handled trays **645, 647, 649** and **651**

[0312] As illustrated in **FIG. 2**, a food item F is being discharged from fry wheel **414** down a chute **653** and into handled tray **649** contained within heated receptacle **641**. Food item F can be stored therein for a period of time until it is ready for subsequent processing

[0313] Referring to **FIGS. 62 and 63**, there is illustrated heated receptacle **643** in a cross-sectional view and **FIG. 63** is a cross-sectional view taken along line **63-63** of **FIG. 62** showing the entire width of receptacle **643**

[0314] As illustrated in **FIGS. 62 and 63**, heated receptacle **643** is a heated well having a heating element that heats sidewalls **962, 964, 966** and **968** as well as bottom **970** of heated receptacle **643** Heating element **960** is in close proximity to walls **962, 964, 966** and **968** as well as bottom **970** Heating element **960** may be composed of a single heating element or multiple heating elements as desired Suitable controls may be provided to adjust the temperature of walls **962-968** as well as bottom **970** of heated receptacle **643** In addition, suitable insulation **972** can be contained within the cavity that is defined by cabinet **974** of food storage device **635**, which is partially shown in **FIGS. 62 and 63**

[0315] Preferably, handled trays **645-651**, such as handled tray **651** depicted in **FIGS. 62 and 63** are dimensioned such that they are in close proximity to walls **962-968** and bottom **970** when placed in heated receptacle **643**

[0316] Food packaging device **600** may optionally include food seasoning device **616**, which is illustrated in detail in **FIGS. 65-68** Food seasoning device **616** includes a hopper **972**, a metering wheel **974**, a wheel drive system **976**, a dispensing tube **978** and a dispersion head **618**

[0317] Hopper **972** is configured to hold a desired bulk quantity of a seasoning material, such as salt S Bulk hopper **972** includes a lid **982** that can be removed to replenish the supply of salt S contained therein Hopper **972** can have a bottom with inwardly extending sidewalls **984** to facilitate the dispensing of material from bottom **986** of hopper **972** which may include a dispensing tube **988**

[0318] Metering wheel **974** is located beneath bottom **986** and dispensing tube **988** to receive a charge of salt or other seasoning therefrom Metering wheel **974** includes a cavity **990** for receiving a charge of salt from dispensing tube **988**

[0319] Metering wheel **974** is rotatably mounted in a housing **992** and can be rotated about the longitudinal axis of metering wheel **974** to cause cavity **990** to be directed downwardly which thereby causes the seasoning or salt contained in cavity **990** to fall by gravity therefrom

[0320] Metering wheel **974** is suitably rotated by wheel drive system **976** Wheel drive system **976** can be controlled by a suitable electronic control system that can form part of the food packaging device **600** Typically, in operation, when French fries FF are dispensed from one or more of fry wheels **404, 410, 412** and **414** onto chute **604**, a suitable sensing device (not shown) senses the presence of French fries and activates wheel drive system **976** of automated food seasoning device **616** to discharge a predetermined quantity of seasoning, such as salt, onto the French fries that traverse chute **604**

[0321] Dispensing head **618** can be located in a desired position to apply seasoning to the food traversing chute **604** As illustrated in **FIG. 3**, for example, dispensing head **618** can be located towards a bottom portion of inlet chute **604** and may extend over a portion of rotatable food dispensing member **606**

[0322] Wheel drive system **976** as illustrated in **FIGS. 65-68** includes a solenoid plunger **994** for driving a linkage **996** that is connected to metering wheel **974** to impart rotation to metering wheel **974** Linkage **996** includes a crank arm **998**, one end of which is connected to a central portion of metering wheel **974** and the other end is connected to a lever arm **1000** which, in turn, is connected to solenoid plunger **994** Lever arm **1000** can be driven by solenoid plunger **994** which, in turn, causes crank arm **998** to be driven, thereby rotating metering wheel **974** sufficiently to cause cavity **990** to be directed downwardly, thereby permitting any seasoning or salt contained therein to be dispensed therefrom

[0323] A collection funnel **1002** is disposed at the discharge end of housing **992** and connects to dispensing tube **978** Dispensing tube **978** is, in turn, connected to dispensing head **618**

[0324] Dispensing head **618** can include a plurality of vanes **1004** for facilitating dispersion of seasoning dispensed therefrom As illustrated, there are four vanes **1004** spaced **900** from each other

[0325] Dispensing tube **978** has a lower end portion **1006** that terminates some distance above dispensing cone **1008** of dispensing head **618** In one embodiment, lower end portion **1006** of dispensing tube **978** may terminate approximately 0.25 inches from the tip of dispersion cone **1008**

[0326] Dispersion cone **1008** includes a plurality of holes **1010** that are arrayed through dispersion cone **1008** to facilitate the distribution of seasoning or salt In operation, as salt or seasoning is dispensed through lower end portion **1006** of dispensing tube **978**, the seasoning strikes the top portion of dispersion cone **1008** and is directed into four quadrants via vanes **1004** As the seasoning traverses the surface of dispersion cone **1008**, some of the seasoning falls through holes **1010** in dispersion cone **1008** Note that not all of holes **1010** are labeled, for purposes of clarity in the Figures Other salt or seasoning particles do not fall through holes **1010** but fall off the lower end of dispersion cone **1008** Still other seasoning particles bounce or are otherwise deflected off the top surface of dispersion cone **1008** and fall a lateral distance removed from dispersion cone **1008** In this manner, a good distribution of seasoning is achieved over a relatively large area

[0327] The Control System and Method

[0328] In one embodiment, the System Master Controller of a Server (PC), a router/hub, and a touch-screen monitor (user interface) The Master can utilize existing technology to integrate, to manage, to control, and to coordinate information flow of and through the various subsystems for overall system operation The network technology is fully compliant with the latest version of the industry's NAFEM Protocol

[0329] Control System Features

[0330] Referring to **FIGS. 69-73**, the primary functions of the Control System are to receive order information from the POS and to connect and coordinate all operating subsystem controllers with the Master Controller so that operational commands and functional information can be communicated and displayed The result is that all the dispensing, fry and packaging modules function as one integrated fried foods production system

[0331] In one embodiment, the Control System is event and demand driven That is, nothing happens unless a functional component or subsystem receives a command signal to initiate the action In a normal operation mode, the POS will provide virtually all of the system order demands These can take the form of a string of two-bit Order Events Typically this will be a quantity and an item (for example, 2 each regular size fries) The product description can consist of both the food item and its portion size, treated as one bit of information

[0332] The Control System information can be categorized into Order Events, Inbound Events, and Outbound Events The Order Events come from primarily the POS system, the historical kitchen management system (KMS) data, or the touch-screen Monitor if a manager wants to override the automatic ordering KMS is a database of information of, for example, the sales rate of various products versus day and time The Order Events dictate and demand the operation and performance of the automation control system for production The Inbound Events information includes messages generated by subsystem controllers other than the POS or KMS The Outbound Events include typical command messages issued by the Master Controller specifying functions to be performed by individual subsystem controllers

[0333] In one embodiment, the Master Controller is configured to monitor periodically or continuously the network for events to occur Once an event takes place and a signal is sent on the network, the Master Controller identifies the source of the signal, then compares it to the programmed schedule of events within its memory, and reacts appropriately, either sending out a new command, showing a display, storing information in memory, or all of the above

[0334] An important source of data for the Control System can be the Kitchen Management System (KMS) The KMS is a historical database of operational information This information can be used to set the workstation configuration, process settings, inventory levels, and set a level of production in advance of actual customer demand orders This interface can be a two-way connection, so that all operational data from the Fried Foods Workstation can be received and stored in the KMS and/or the Control System, or evaluated, adjusted, and re-entered to "fine-tune" the process on a continuing basis

[0335] Generally, the Control System can comprise two loops, shown in **FIG. 70** The primary loop is the "Order-to-Package" loop, whereby the Master Control takes an Order Event input from the POS and directs the appropriate Packaging Module subsystem to package and deliver an appropriate portion of product A secondary loop is the "Buffer Replacement" loop, where the Master Controller receives an Inbound Event signal from the Packaging Module that its buffer inventory of ready-to-package fried product is low and additional product must be dispensed and fried As currently specified, all products other than salted French fries typically can have a default buffer inventory of zero, meaning that an order for that (other) product will immediately initiate a full dispense-fry-package (if packaged by the System) production routine

[0336] In accordance with one aspect of this embodiment of the Control System, the Fryer Module vat operation is not directly controlled by the production demand cycle Each fry vat of the fry module will operate continuously and on a pre-set uniform operating cycle Frozen product is dropped into the fry module when additional inventory is called for The product is fried according to the pre-set cooking cycle and then is dumped into the Packaging (or Protein) Module receiving apron None of the cooking cycle is affected by order demands, or inventory conditions. In one embodiment, the Control System can vary the time between incremental rotation and speed of rotation of fry wheel **410** to accommodate for varying conditions, such as the level of cooking oil in the fry vat. The level of cooking oil can vary as a result of the amount of product that is being fried in a particular fry vat, since product present in the fry vat displaces cooking oil, thereby raising the level of cooking oil in the fry vat particularly since the product is held below the cooking oil surface during a cooking cycle Preferably, to ensure the

workstation reliability and system uptime, extensive control redundancy can be provided As a result, the control subsystems for each Fryer Module vat and each Dispensing Module chute are designed and constructed as individual units that operate even if one or more subsystem fails

[0337] Additionally, the control of the Dispensing Module freezer environment and operation can be an independent subsystem

[0338] Preferably, the Control System includes the capability to operate all modules individually This allows the operator to disconnect and remove a module from the network and operate the remaining modules in a semi-automatic method, manually performing some of the operations Preferably, there are controls on each module that permit an operator to operate that module's functions locally

[0339] Orders for product are preferably processed sequentially as they are received, although the specific products within a customer order may be arranged in a logical manner as desired The Monitor will display all products being processed by the workstation from the time the order is received until it is removed from the workstation. The status of each product that is ordered can be tracked in its various stages including, for example, on order, packaged and ready to pick up, ready to manually package, and held too long

[0340] Preferably, products in the process of being fried can also be tracked, and cooking times for each basket in each wheel will count down to when product is ready to package

[0341] Master Controller

[0342] In one embodiment, the Master Controller **110** hardware may suitably comprise, or equivalent:

[0343] Intel Pentium III (or higher) with 1 0 GHz (or higher) CPU

[0344] Ethernet network interface and hub

[0345] 256 MB (or more) system RAM

[0346] 20 GB (or more) hard disk drive

[0347] Touch-Screen Monitor Interface

[0348] Plug and Play Touch-Screen Monitor

[0349] SCK Gateway (Ethernet)

[0350] Interconnect cabling (as needed)

[0351] Optional Keyboard and pointing device (mouse) for installation and maintenance purposes

[0352] Typical operating system software requirements are:

[0353] Windows 2000 professional (or server) SP4 or higher

[0354] A suitable Database Server, such as Fast SCK Version 3 0 (or higher) from Fast, Inc of Stratford, Conn

[0355] Fast SCK Version 3 0 (or higher) Utility Applications (SCK Editor, SCK Engine, SCK Events, and SCK Site Editor) from Fast, Inc

[0356] The Subsystem Interface Modules provide the functionality to communicate specific control events (information) conditions, and/or commands to and from the Master Controller These modules typically can be incorporated into the circuitry of controller boards In cases where the network needs to interface with a control subsystem (such as PLCs, for example), appropriate imbedded memory interface (input-output) circuit cards known in the art can be utilized All of the foregoing hardware and software or equivalent is readily available or can be produced by those skilled in the art

[0357] Fryer Controller

[0358] The frying of the frozen product is controlled by a combination of cooking oil temperature and the time the frozen product is immersed in the cooking oil. Frying is accomplished by moving the frozen product through the heated cooking oil by a rotating fry wheel. As previously described, a programmable stepper or other motor can provide the desired precisely controlled movement of the fry wheel

[0359] The following Table I lists typical control parameters and several optional parameters that can be used, if desired

TABLE I

Fryer Module Control Signals
(One set for each of 4 Product Lanes)

Description	Input	Output	Op Adj
Set Temperature	X		X
Actual Temperature		X	
"Ready" Band Width		X	
Temperature Offset	X		
C or F	X		X
Probe #1	X		
Heater Relay #1		X	
Total Cook Time	X		X
Jog Speed	X		
Jiggle Time	X		
Cleaner Level		X	
Oil Fill		X	
Cleaner Fill		X	
Probe #2	X		
Heater Relay #2		X	
Flex Time	X		

[0360] **FIG. 71** depicts a typical motor/fry wheel/basket cycle Virtually every parameter can be fixed or adjustable as desired For example, during one typical cycle, which may be for a preset period of time that is one-quarter of the cooking time for food contained in a compartment, fry wheel **410** is rotated clockwise **450** in the direction of arrow K of **FIG. 13** After some period of time after the 45° incremental rotation, a basket shaking simulation of back and forth rotation occurs over a period of about two seconds After a 0 to 10 second delay, another basket simulation shaking occurs. Thereafter, a period of time ("Basket Load Window') is available for loading another compartment, such as compartment **436** with a charge of French fries or other food to be fried Thereafter, a "no load zone" or relatively short period of time towards the end of the cycle is set aside just prior to another 45° fry wheel **410** rotation in the direction of arrow K, which commences another cycle During each cycle, three "home routines" can be employed, one after

each rotation of fry wheel **410** to accurately locate fry wheel **410** so that it is properly positioned with the upper end of compartment bottom **508** of one of fry wheel **410** compartments adjacent discharge **498** and another of the compartments properly aligned to receive a charge of French fries or other food to be fried, such as from food dispensing device **200**

[0361] To ensure proper operation of the basket/fry wheel, including positioning the unit precisely for smooth loading and complete unloading, the basket/fry wheel position must be constantly synchronized To do this, a "homing" sensor circuit can be utilized that resets the home position after every move of the wheel This sensor preferably is electromagnetic and is impervious to dirt and grease build up and has no moving parts although any suitable sensor can be used

[0362] Dispensing Controller

[0363] The Dispensing Module control system **114** separates functions by the product delivery lane they support In one embodiment, where there are four delivery lanes, there are four control subsystems Each subsystem controls a vibrating product conveyor, a portioning load cell, and a dump actuator Additionally, there are optional module configurations that affect the controls design If lanes **1**, **2**, and/or **3** are configured with bulk food hoppers, a product level sensor can be provided to alert operators to reload frozen product before the hopper is empty If each of lanes **2**, **3** and/or **4** are configured with an array of coil magazines for food items, the controls must sequentially switch power to each of the motors in the lane to maintain a constant flow of frozen product

[0364] Table II lists defined control signal parameters for each of the Dispensing Module Lane controllers:

TABLE II

Dispensing Control Signals
(One set for each of 4 Product Lanes)

Description	Input	Output
Load - Small Qty	X	
Load - Large Qty	X	
Load Coil A	X	
Load Coil B	X	
Load Coil C	X	
Load Coil D	X	
Load Coil E	X	
Ready to Dump		X
Vibrator Frequency	X	
Bulk Fill Level		X
Time Out		X
Overweight		X
Clean Out	X	

[0365] Freezer Controller

[0366] In addition to properly dispensing products into the Fryer Module, the dispensing device **200** control **114** must also maintain a proper frozen environment for all products To accomplish this, another controller subsystem can be provided Table III lists the applicable control signal parameters for the freezer subsystem A safety circuit interrupts all dispensing activity when the aisle door is opened

TABLE III

Freezer Control Signals

Description	Input	Output	Op. Adj
Set Temperature	X		X
Actual Temperature		X	
Aisle Door Open		X	

[0367] The separation of the Dispensing Module controls into these five subsystems when there are five makes for a convenient mechanical arrangement in the base of the module, and allows for the required flexibility given the configuration options

[0368] In one embodiment, for manual operation, four "dispense" buttons are provided, one for each lane One button would cause the release of a pre-set portion of the frozen product for that lane The controls preferably should be located so the operator could by visual observation determine the appropriate Fryer basket to make sure the product dispenses into the proper basket

[0369] Packaging Controller

[0370] Packaging Controller **118** for the Packaging Module incorporates several event signal generators for the control system to sense or read The main Packaging Module or device **600** elements are depicted in **FIGS. 25-29** In one embodiment, the Packaging Module or device control system includes two subsystems within the Packaging Module, the packaging subsystem and the heated food storage device **635** that can be used in place of packaging device **600**

[0371] The Packaging Subsystem

[0372] The packaging control subsystem initially interfaces with the Packaging Module PLC and sends packaging device **600** a signal to start the sequential operation of packaging one of an appropriately-sized portion of French fries The actions and reactions of all the electromechanical devices (e g , container handling system **610**, dispensing member **606**, overflow member **613**, load cell **702** and chute mechanism **608**) can be, if desired, sequenced and controlled by the local on-board controller (i.e , PLC) and not Master Controller **110**

[0373] Once the automated arm **764** sets the filled package of fries on conveyor **614** and the receptacle load gate **926** opens to allow receptacle **612** to move to the pick up area, a signal will be sent back to Master Controller **110** indicating that the particular order of fries is ready for pick up Until that receptacle **612** moves to the return gate **928** (located at the operator right front of the Packaging Module) and the gate permits receptacle **612** to move therepast after receptacle **612** is empty, Master Controller **110** will believe (and display) that the order of fries is waiting to be picked up Preferably, the crew member will pick up fries from right to left to ensure that the order sequence is followed and that the oldest fries are served first

[0374] Because the number of receptacles **612** that can fit between gate **926** and return gate **928** typically is limited, Master Controller **110** intelligence preferably keeps track of how many orders of fries are in the pick up cue This allows audible/visual alerts to be triggered on the Monitor to

remind the crew that orders have been waiting. Also, even if orders are picked out of sequence, the Master Controller will remember what was on an empty receptacle **612** and clear it when it passes return gate **928**

[**0375**] Preferably, the Master Controller is configured to remember the hold time of each packaged fry order. If the order has not been picked up in time, the Monitor will alert the operator by audible/visual signal to "waste" that order

[**0376**] The Secondary Loop

[**0377**] The remainder of the Packaging Module or device **600** control **118** functions address the secondary loop, "buffer inventory replacement." Preferably, there are two typical system requirements for the buffer inventory: (1) there must be a minimum amount of fries in member **606** or chute mechanism **608** to completely fill the next packaging order (that is, one portion of a given size); and (2) the buffer inventory is low and needs to be replenished

[**0378**] For the first requirement, if there is insufficient buffer inventory to fill the package, chute mechanism **608** is disabled and an error message alarm is sent. This condition should not happen, but the control intelligence prevents packaging device **600** from under filling an order.

[**0379**] During normal operations, the level of fries in the buffer inventory will drop to a level where an inventory replenishment order will be initiated. In that event, Master Controller **110** can signal dispensing device **200** to start its fill sequence. This process should typically start soon enough that the replacement product can be fried, salted, and added to the dispensing member **606** before the "out-of-product" condition is reached. The KMS data can be integrated into the Master Control intelligence to help insure that there is replacement product in process before the actual need arises. This capability minimizes order delivery delays while also preventing the dispensing member **606** inventory growing beyond actual need

[**0380**] The dispensing member **606** inventory can be managed in a number of ways, as desired. For example, any of the following can be utilized and implemented by one of ordinary skill in the art: (a) direct sensors; (b) a load cell that constantly weighs the buffer inventory; and (c) a dynamic empirical calculation.

[**0381**] The dynamic empirical calculation embodiment uses the Master Controller to constantly calculate how much product has been added to dispensing member **606**, and subtract out the portion packaged, any bonus amount, waste, and a safety factor. This empirical total will then be compared to pre-set "reload" levels. The formula may also include how much product is in process. In all cases, the buffer inventory level can be adjusted during the day to reflect actual sales levels

[**0382**] The controls system design for all other (i.e., non-salted French fries) products is that the same control process would be used, but that the "buffer inventory" for those products would be defaulted to zero. That is, an order for hash browns would immediately signal an "out-of-inventory" condition and launch an "inventory replacement" command to the dispensing device **200**. Later, if the need arises, controller intelligence would allow the operator to utilize some buffer inventory for these products

[**0383**] Optionally, a provision can be made for unsalted French fries. Unsalted French fries would be handled like the non-French fries products. When an order for unsalted French fries is received, Master Controller **110** will signal the Packaging Module to move diverter bar **605**. The next load of French fries coming from the Fryer Module will then be diverted to a portion of chute **604** of packaging device **600** for manual packaging. The extra unsalted fries can be manually returned to chute **604**

[**0384**] An important feature of the automated system is to maintain product integrity. One facet of that is to dispose of product that has exceeded its authorized holding time. Master Controller **110** will remember when each load of French fries came out of fry device **400**. The mechanical design of packaging device **600** assures a substantially "first in-first out" product movement. How long the "oldest" fries have been in dispensing member **606** is tracked by Master Controller **110** or packaging device controller **118**, as desired. Whenever the allowable holding time has been reached, Master Controller **110** will signal the Packaging Module subsystem Controller **118** to start the buffer waste cycle (or the packaging device Controller **118** can directly control this function). It is possible that some French fries in the buffer will not have reached their limit, but through control parameter refinement, this can be minimized. Table IV lists the control signals for one embodiment of the packaging control subsystem:

TABLE IV

Packaging Control Signals

Description	Input	Output	Op Adj
Package #1	X		
Package #2	X		
Package #3	X		
Package #4	X		
Divert Fries	X		
Produce #5	X		
Produce #6	X		
Produce #7	X		
Produce #8	X		
Produce #9	X		
Dump Buffer	X		
Buffer Low		X	
Buffer Full		X	
Receptacle Loaded		X	
Receptacle Empty		X	
Time out - System 610		X	
Product #5 - 9 Picked		X	

[**0385**] Holding Controller

[**0386**] The other control subsystem is that dedicated to holding product at proper temperatures. Generally, a standard temperature controller with timer channels to manage all holding functions can be utilized, as is known in the art

[0387] Table V lists the various control parameters for the holding control subsystem for food holding device **635**:

TABLE V

Holding Control Signals

Description	Input	Output	Op Adj
Buffer Temp Set	X		X
Buffer Temp Act		X	
Pick Up Temp Set	X		X
Pick Up Temp Act		X	
Apron Temp Set	X		X
Apron Temp Act		X	
Holding Temp Set	X		X
Holding Temp Act		X	
Holding Time #1 Start	X		
Holding Time #1 End	X		
Holding Time #2 Start	X		
Holding Time #1 End	X		

[0388] Touch-Screen Monitor

[0389] The Touch-Screen Monitor is the primary system user interface and can be considered part of the Master Controller configuration. The Monitor has four main functions: (1) display the status of fried foods orders; (2) allow the operator to manually control the system; (3) alert the operator to any needed manual intervention; and (4) allow the operator to reconfigure the workstation and/or change the individual operating parameters.

[0390] The Monitor display can be configured as desired. Preferably, the main display menu is simple, uncluttered and only presents the basic information needed to track ongoing order status. A sample Monitor display layout is shown in **FIG. 72**.

[0391] In the illustrated embodiment, products on order would appear as horizontal rows of the appropriate product (type and portion size) icon, reading from the left edge of the screen. All products from a single POS customer order would appear on a single line. As additional POS orders are entered, the screen would refresh, moving the older orders down a line. Products on order, and not yet ready for pick up would appear as gold icons.

[0392] Across the bottom of the screen would appear the same number of locations as there are packaging device **600** receptacles **612** in the pick up zone. As packages of fries are placed on receptacles **612** and the receptacles **612** travel within the pick up zone, the appropriate icon will disappear from the "on order" line and reappear as a green icon in the spot where its receptacle is. When a package is removed from a receptacle and that receptacle passes return gate **928**, the display icon will disappear from the screen.

[0393] In one embodiment, should the "hold timer" for a packaged product expire before it is picked up, its green icon will change color (i.e., to red) and/or flash. In another embodiment, an audible alarm can be provided as well, indicating clearly that this product should be wasted.

[0394] Across the top of the screen is a line of control "buttons." There can be one for each product (again, type and portion size). The system is programmed so that touching the button on the screen will enter an order for one each of that product. There is also a screen button at the upper right corner of the screen that enables the operator to change the screen display to the "Settings" screen.

[0395] The "Settings" screen layout is depicted in **FIG. 73**. From this screen, the operator may now configure all the operating settings for the product to be run in each product lane. The individual settings may include dispensing load size(s), fry vat temperature, cooking cycle time, buffer inventory level, packaging device Module heater setting, and other settings as desired. In this embodiment, all settings for a particular product are linked to that product. The operator can merely scroll in each product lane and signify the product that will be run in it. Master Controller **110** will then set all operating parameters for that product. If it is necessary to check or adjust an individual control setting (such as cook time), the operator can scroll through the items in the "settings" box for that lane and product. Then, using the "up" and "down" keys, readjust the setting and press the "enter" key to reset.

[0396] If required, a secure "manager only screen" can be configured to allow someone to adjust and/or reset selected operating parameters. Access to this screen and these settings would require some type of password to prevent any non-authorized store employee from changing basic system parameters.

[0397] Operator alert messages or alarms (e.g., bulk product low—refill now; "bridging/time out"—clear lane **2**; etc.) will appear as an "error message box" in the center of the screen, along with some type of audible alarm.

[0398] While the invention has been described with respect to certain preferred embodiments, as will be appreciated by those skilled in the art, it is to be understood that the invention is capable of numerous changes, modifications and rearrangements and such changes, modifications and rearrangements are intended to be covered by the following claims.

1. An automated modular system for dispensing, frying and packaging food into individual portion-sized containers comprising:

an automated dispensing module contained in a first housing, capable of dispensing a desired quantity of food to be fried;

an automated fry module contained in a second housing, separate from the first housing and located adjacent the dispensing module to receive and fry the quantity of food dispensed from the dispensing module, and to produce and dispense a quantity of fried food; and

an automated packaging module contained in a third housing, separate from the first and second housings and located adjacent the fry module to receive and package the fried food from the fry module into an individual portion-sized container.

2. The automated modular system of claim 1 wherein the three modules are independent from each other and can be operated independently.

3. The automated modular system of claim 2 wherein any one of the modules can be deactivated and a human operator can manually perform the function of the deactivated module with manually operated equipment.

4. The automated modular system of claim 1 further comprising an automated seasoning device to put seasoning on the food.

5. The automated modular system of claim 1 wherein said dispensing module is capable of dispensing one or more of French fries, chicken nuggets, hash browns, chicken patties and fish filets.

6. The automated modular system of claim 1 wherein said automated dispensing module comprises:

a freezer;

a storage container located in the freezer for containing food to be dispensed;

means for dispensing a predetermined quantity of food from the storage container into a secondary container, said means for dispensing and said secondary container located in the freezer; and

means for dispensing the quantity of food from the secondary container to a location outside of the freezer.

7. The automated modular system of claim 1 wherein said fry module comprises:

(a) a fry vat for containing and heating cooking oil;

(b) at least one circular fry wheel having at least a generally circular perimeter and a plurality of compartments, each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel, which radial axis is disposed above the normal operating level of the frying oil in the fry vat; and

(c) a drive mechanism for rotating the fry wheel.

8. The automated modular system of claim 7 further comprising a control system programmed to cause the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation to simulate shaking of a fry basket.

9. An automated system for dispensing, frying and packaging French fries into individual portion-sized containers comprising:

an automated dispensing device contained in a first housing, capable of dispensing a desired quantity portion of French fries to be fried;

an automated fry device contained in a second housing, separate from the first housing and located proximate the dispensing device to receive and fry the portion of French fries dispensed from the dispensing device, and to produce and dispense a quantity of fried French fries; and

an automated packaging device contained in a third housing, separate from the first and second housings and located proximate the fry device to receive and package the fried French fries from the fry device into an individual portion-sized French fry container.

10. The automated system of claim 9 wherein the three devices are independent from each other and can be operated independently.

11. The automated system of claim 10 wherein any one of the devices can be deactivated and a human operator can manually perform the function of the deactivated device with manually operated equipment.

12. The automated system of claim 9 further comprising a seasoning device to put seasoning on the French fries.

13. The automated system of claim 9 wherein said automated dispensing device comprises:

a freezer;

a storage container located in the freezer for containing frozen French fries to be dispensed;

a device for dispensing a predetermined quantity of French fries from the storage container into a secondary container, said device for dispensing and said secondary container located in the freezer; and

means for dispensing the quantity of food from the secondary container to a location outside of the freezer.

14. An automated system for dispensing, frying and storing cooked food comprising:

an automated dispensing device contained in a first housing, capable of dispensing a desired quantity portion of food to be cooked;

an automated fry device contained in a second housing, separate from the first housing and located proximate the dispensing device to directly receive and fry the portion of food dispensed from the dispensing device, and to produce and dispense a quantity of fried French fries; and

a food receiving device contained in a third housing, separate form the first and second housings and located proximate the fry device to directly receive and store the cooked food received from the fry device.

15. The automated system of claim 14 wherein said automated dispensing device comprises:

a freezer;

a storage container located in the freezer for containing frozen food to be dispensed;

a device for dispensing a predetermined quantity of French fries from the storage container into a secondary container, said device for dispensing and said secondary container located in the freezer; and

means for dispensing the quantity of food from the secondary container to a location outside of the freezer.

16. The automated system of claim 14 wherein said fry device comprises:

(a) a fry vat for containing and heating cooking oil;

(b) at least one circular fry wheel having at least a generally circular perimeter and a plurality of compartments each suitable for containing a plurality of French fries, each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel, which radial axis is disposed above the normal operating level of the frying oil in the fry vat; and

(c) a drive mechanism for rotating the fry wheel.

17. The automated system of claim 16 further comprising a control system for causing the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation to simulate shaking of a French fry basket.

18 The automated device of claim 14 wherein said food receiving device is heated.

19. The automated device of claim 18 wherein said food receiving device comprises a heated holding bin positioned to receive food from an outlet slide located between the fry module and the food receiving device.

20 The automated system of claim 19 wherein said holding bin comprises four heated sides and a heated bottom

* * * * *

EXHIBIT I

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(54) AUTOMATED FOOD FRYING DEVICE AND METHOD

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(57) ABSTRACT

An automated food processing system is provided that allows food to be dispensed, fried and packaged in a container, for example, an individual portion-sized container The system includes separate automated modules for dispensing, frying and packaging food An automated dispensing device dispenses a predetermined portion of food from a bulk storage container or food dispensing magazine Food is dispensed from the automated dispensing device to an automated fry device that can include at least one circular fry wheel having a plurality of food containing compartments After the food is fried, it is dispensed from the fry device to an automated packaging device The automated packaging device dispenses food to a container, for example, an individual portion-sized container that is retrieved, erected and held in position for filling by an automated container handling system After a food container is filled, a conveyor system transports the container to a pick-up location

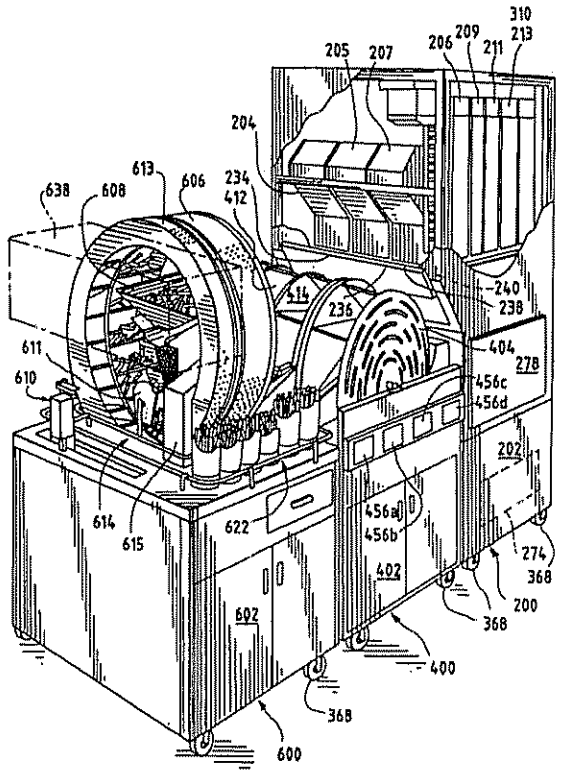

FIG. 1

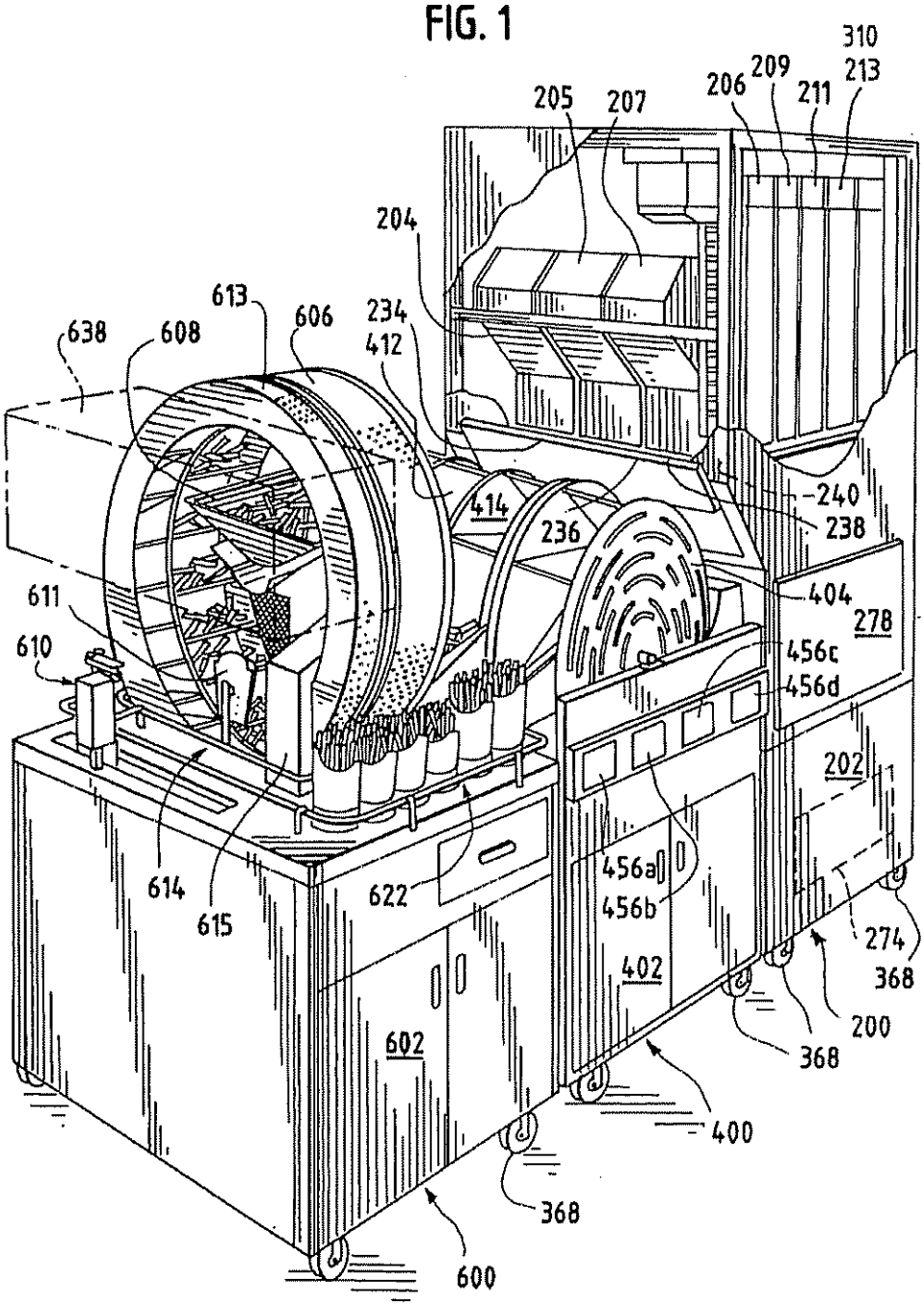
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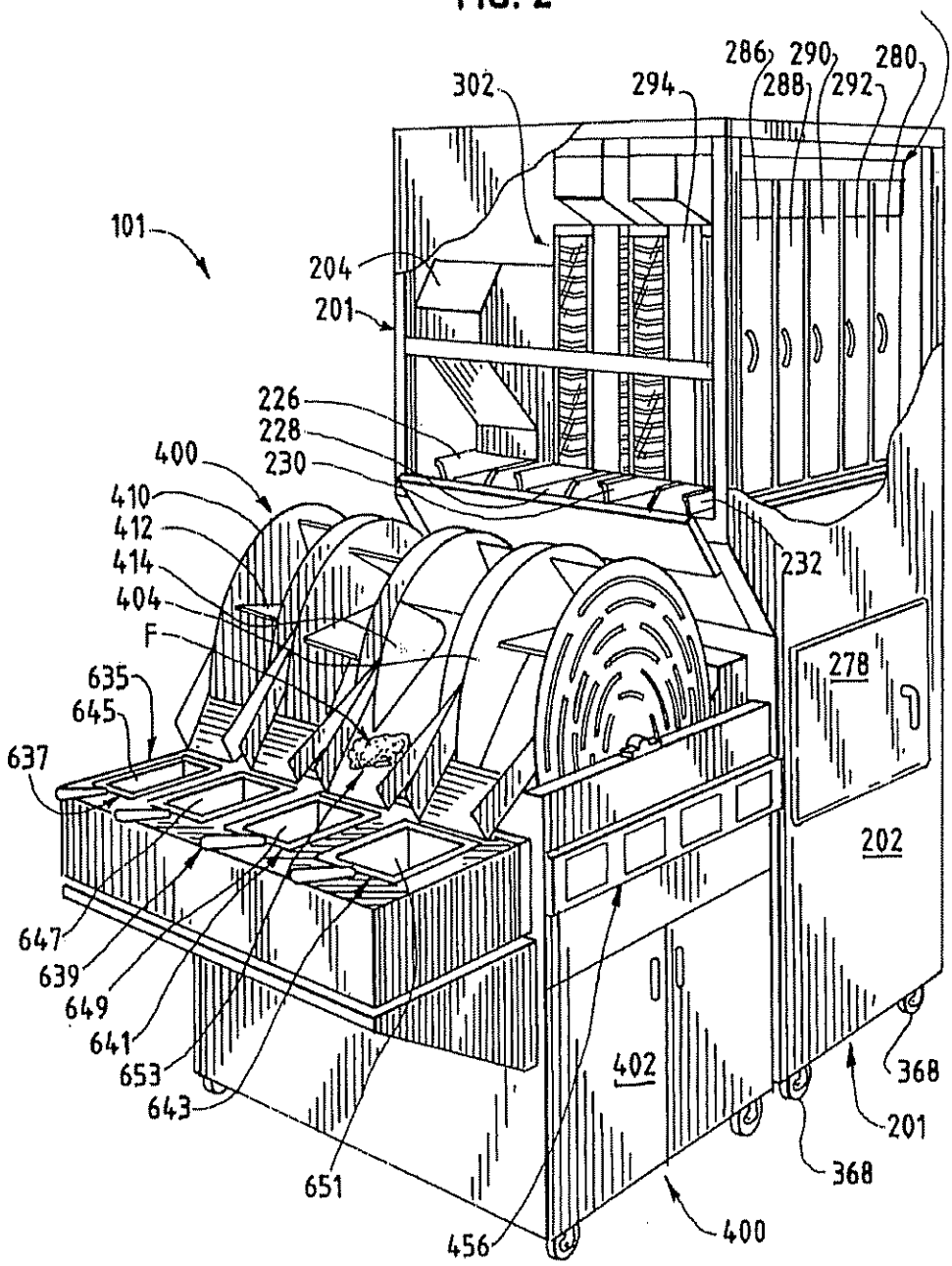
FIG. 2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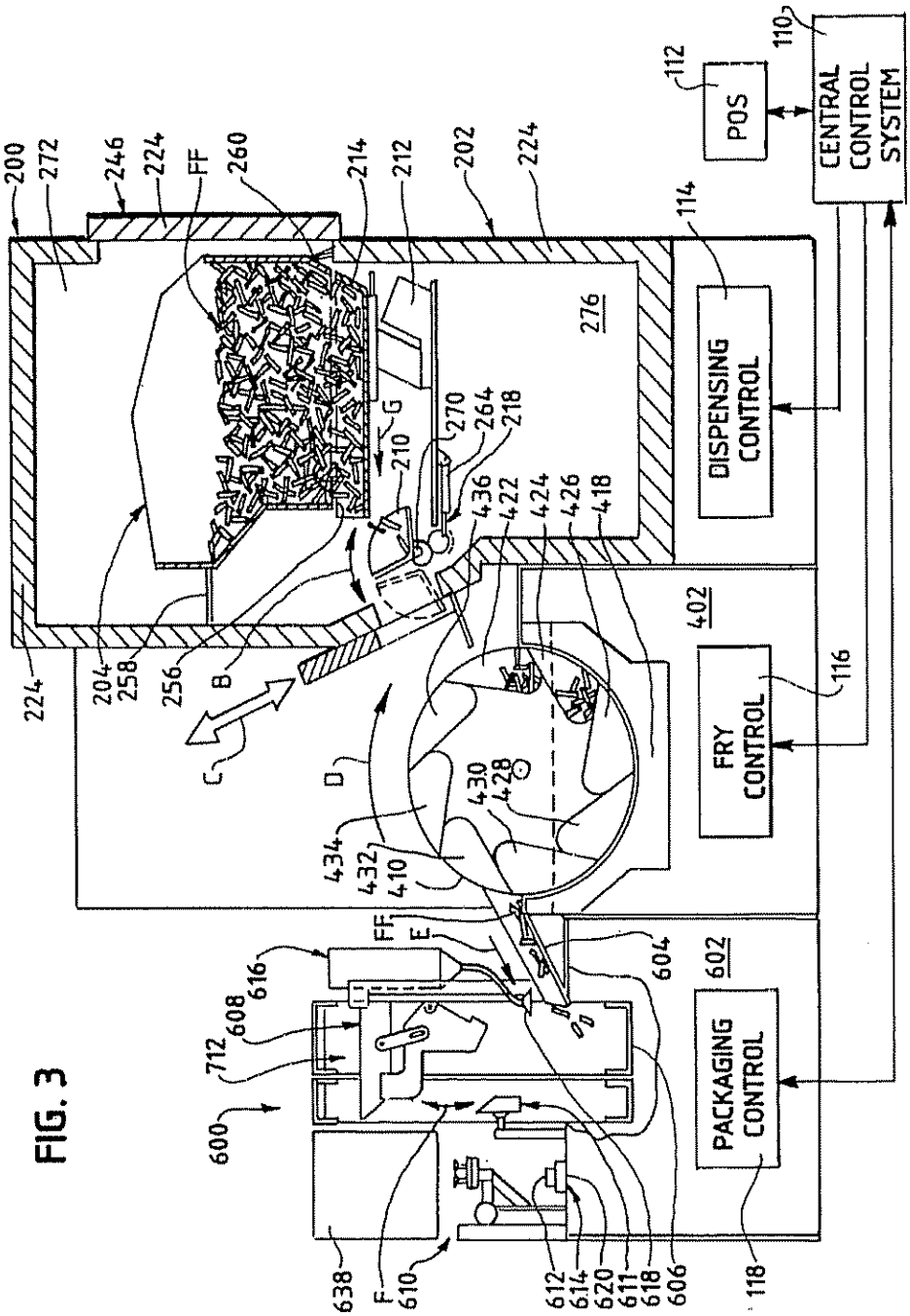

CENTRAL CONTROL SYSTEM
110
POS
112
DISPENSING CONTROL
114
FRY CONTROL
116
PACKAGING CONTROL
118
602
402
276
200
272
246
224
FF
260
214
212
202
224
270
264
218
210
G
436
422
424
426
418
204
258
256
B
C
D
430
428
434
432
410
E
604
616
608
712
600
638
F
610
612
614
620
611
618
606

FIG. 3

FIG. 4

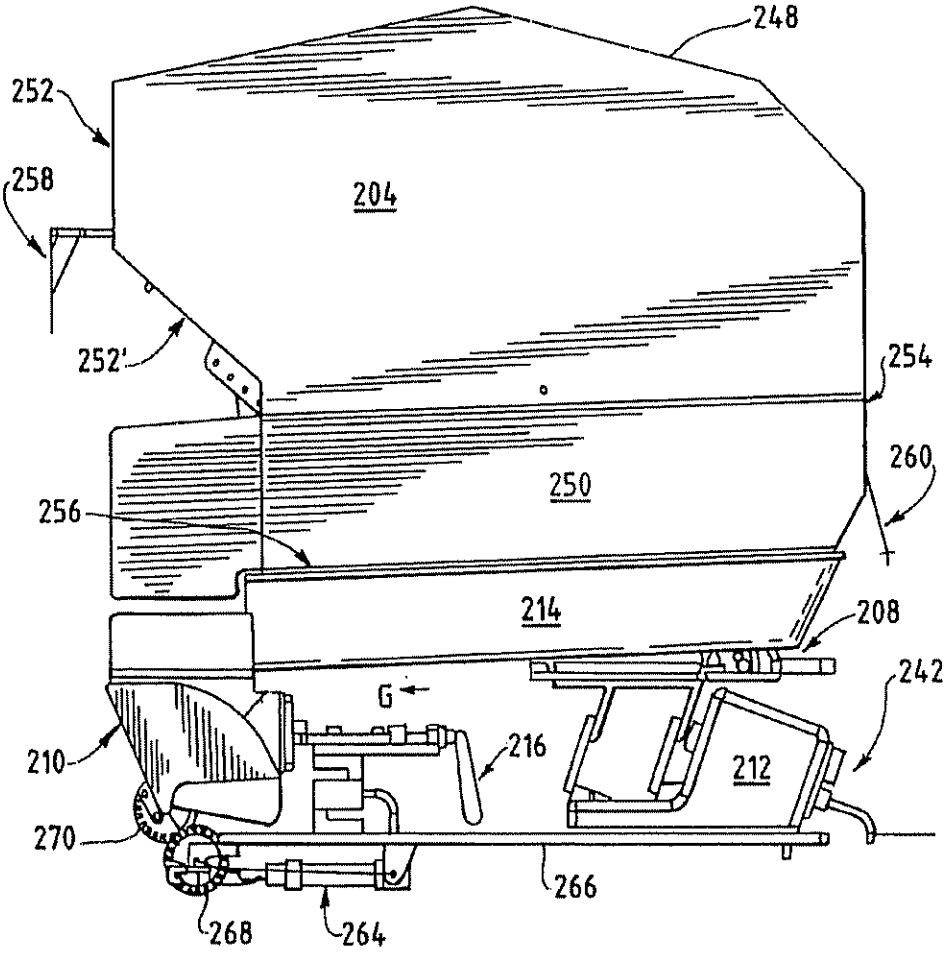

248
252
258
204
252'
254
260
250
256
214
208
242
G
210
216
212
270
266
268
264

FIG. 4A

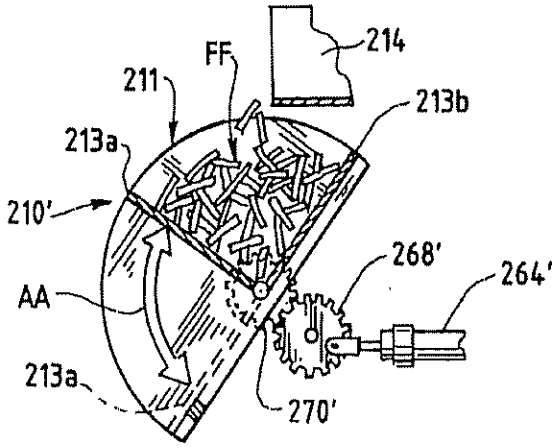

214
FF
211
213b
213a
210'
268'
264'
AA
213a
270'

FIG. 5

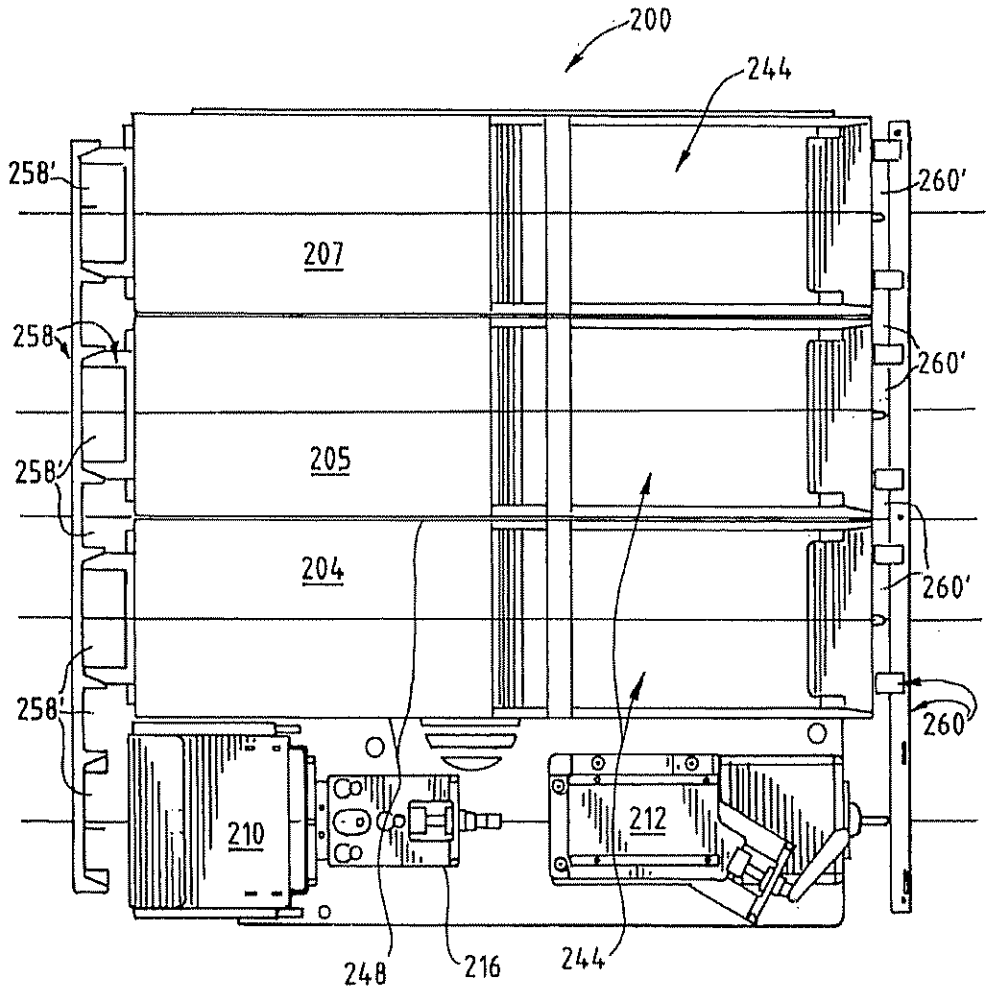

200
244
258'
260'
207
258
260'
205
258'
204
260'
258'
260'
210
212
248
216
244

FIG. 6

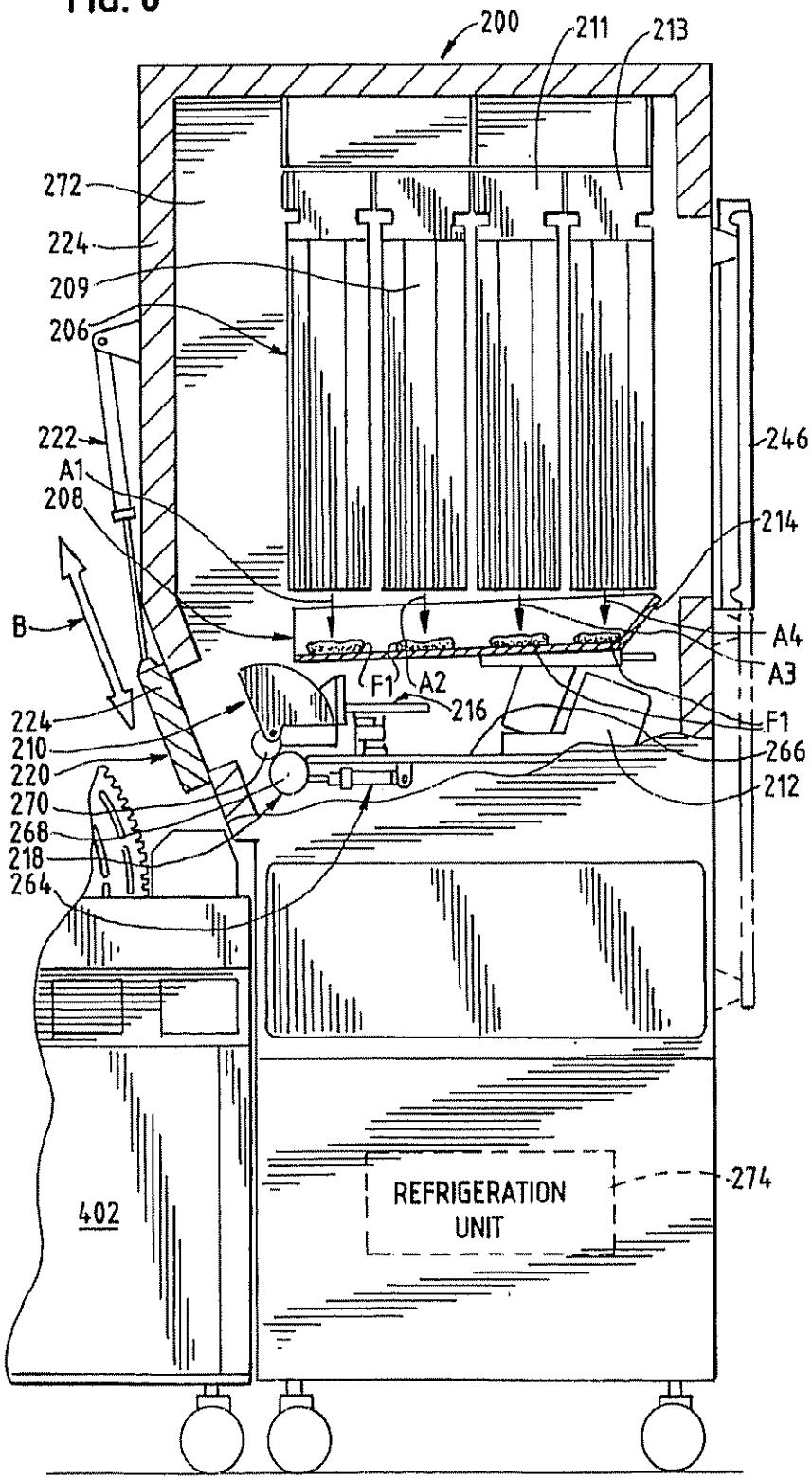

200
211
213
272
224
209
206
222
A1
208
B
224
210
220
270
268
218
264
246
214
A4
A3
F1
A2
216
F1
266
212
REFRIGERATION UNIT
274
402

FIG. 7

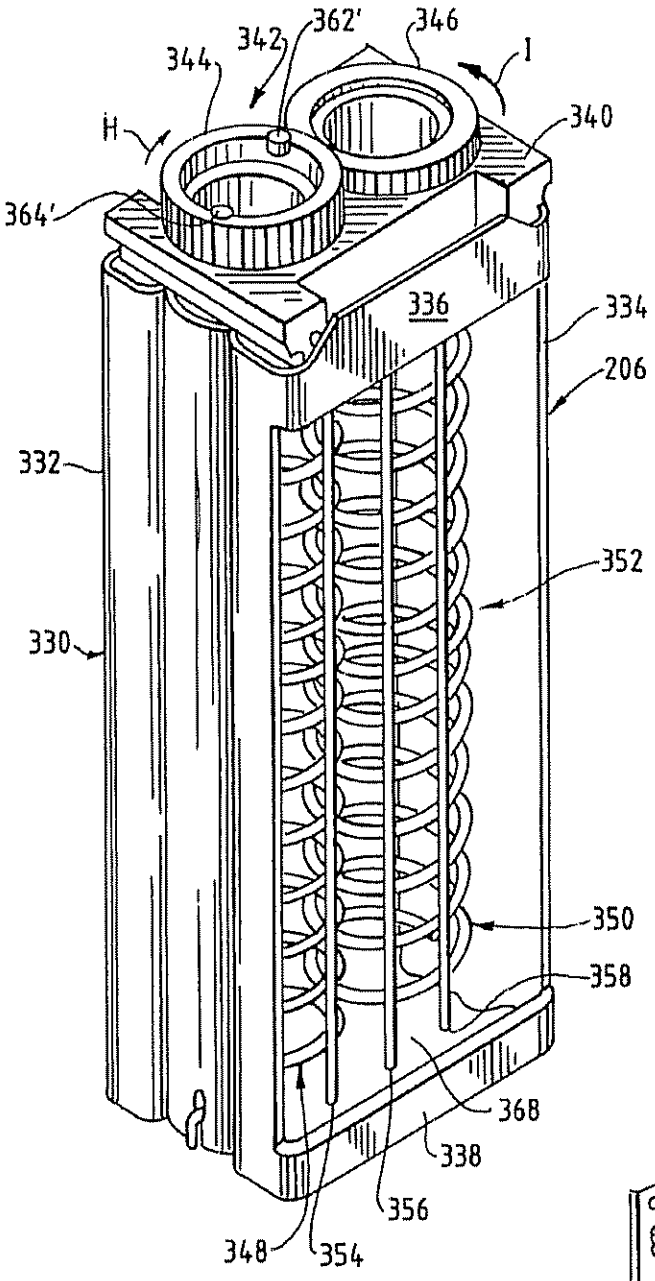

362'
346
342
344
I
H
340
364'
336
334
206
332
352
330
350
358
368
338
356
348
354

FIG. 8

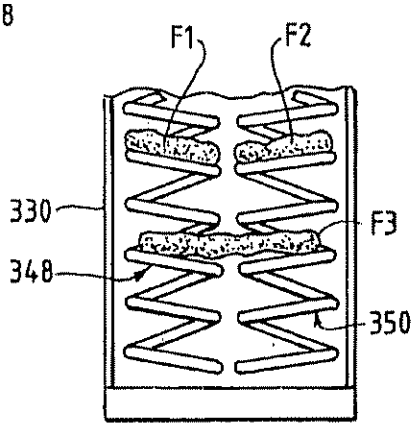

F1
F2
330
F3
348
350

FIG. 9

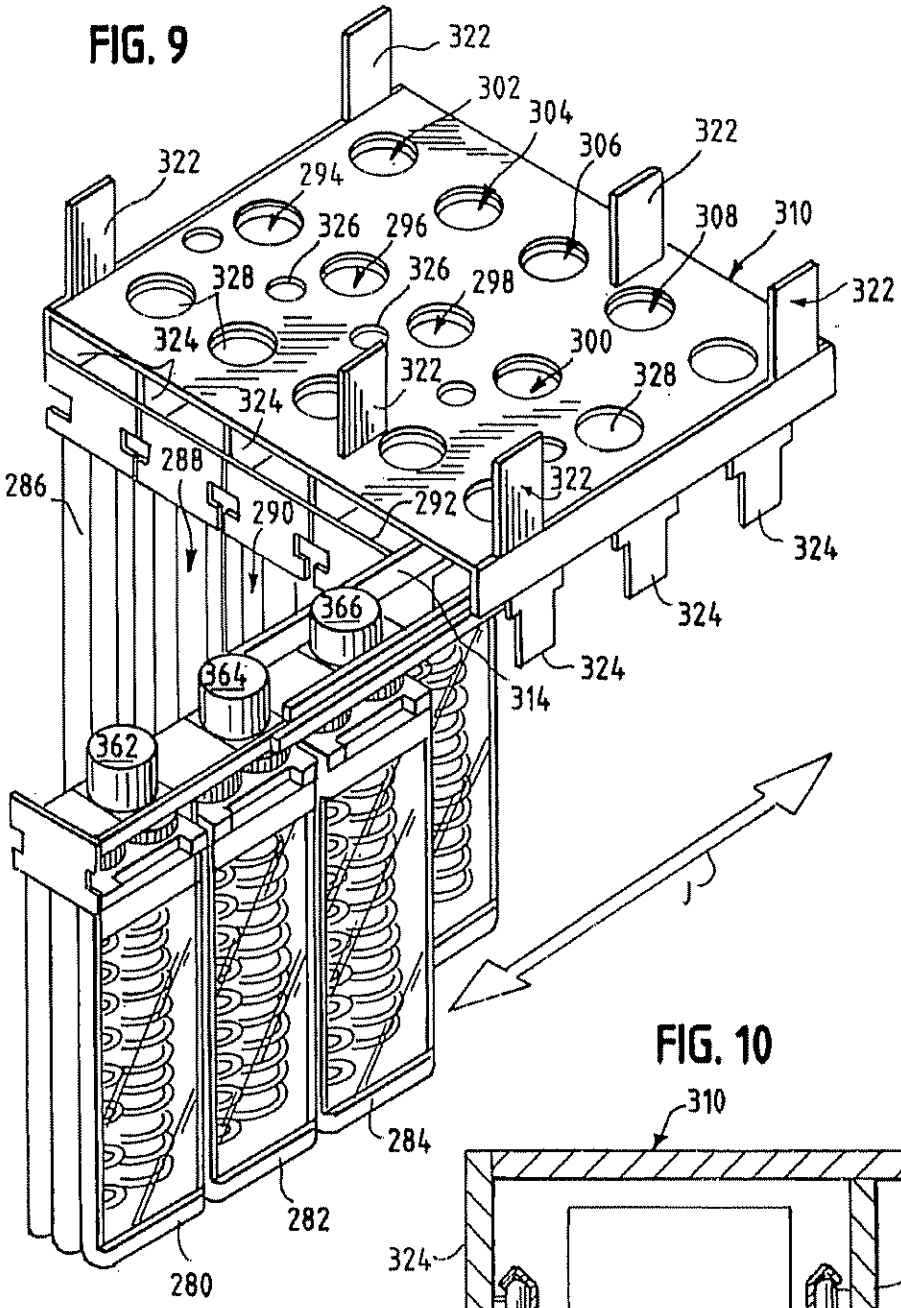

322
302
304
306
322
322
294
308
310
326
296
326
328
298
322
324
300
328
324
322
288
286
290
292
322
324
324
366
324
364
314
362
J
284
282
280

FIG. 10

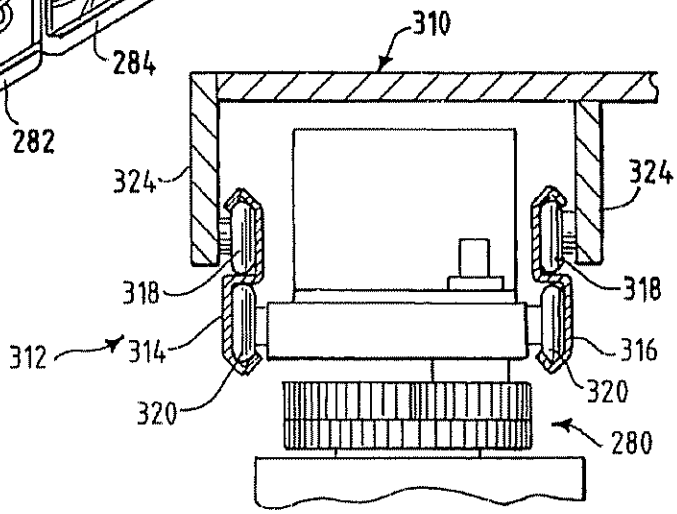

310
324
324
318
318
312
314
316
320
320
280

FIG. 11

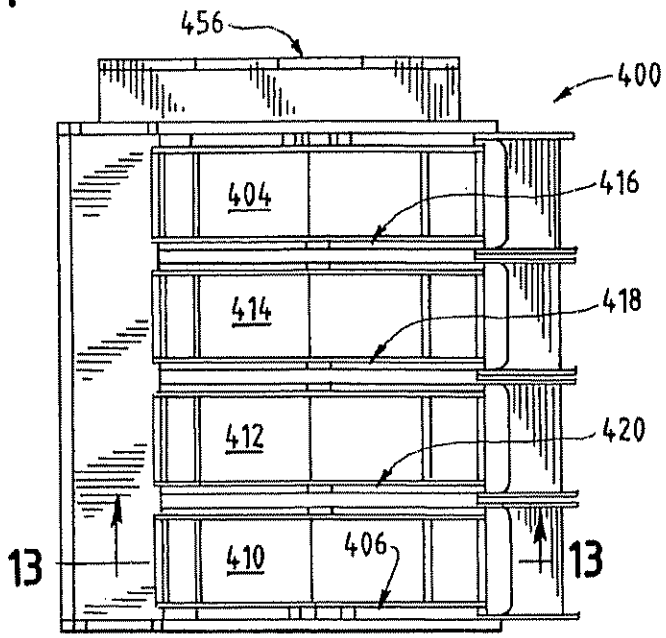

456
400
404
416
414
418
412
420
410
406
13
13

FIG. 12

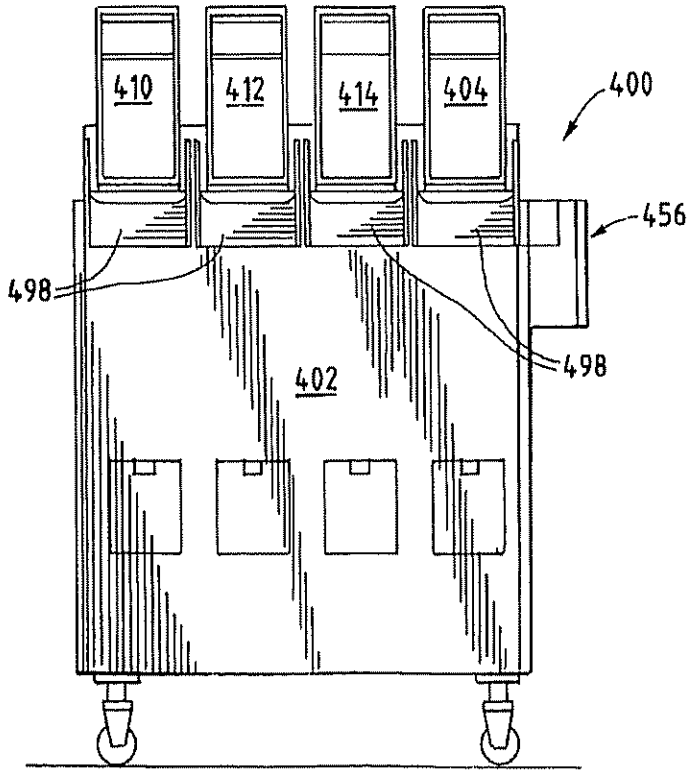

410
412
414
404
400
456
498
498
402

FIG. 13

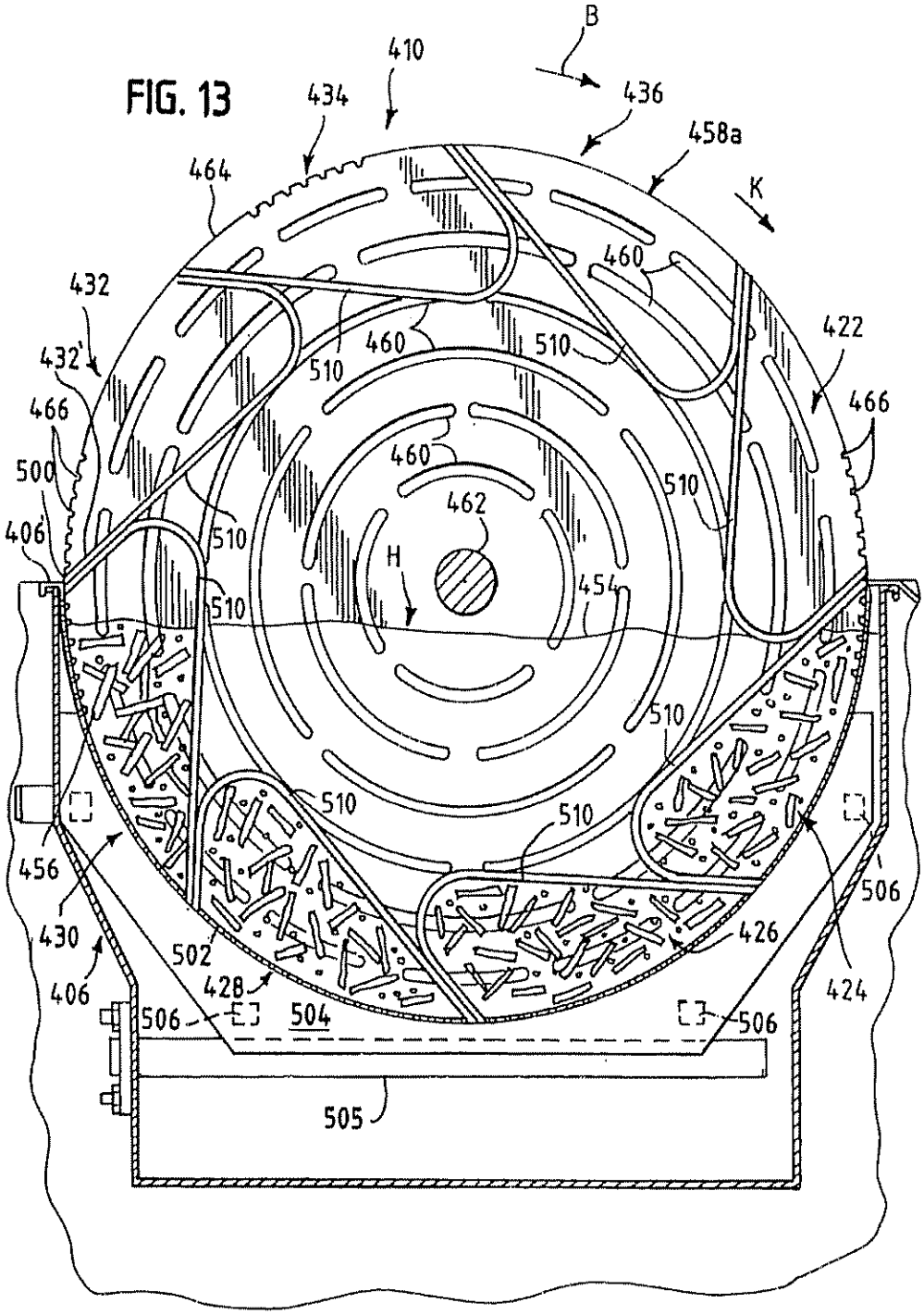

B
410
434
436
458a
K
464
460
432
422
432'
466
510
460
510
466
500
460
462
510
406
H
510
454
510
510
510
456
506
430
426
502
424
428
506
504
506
505

FIG. 14

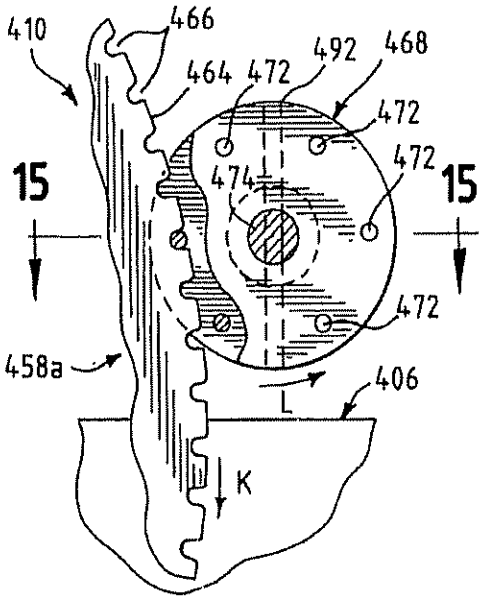


FIG. 15

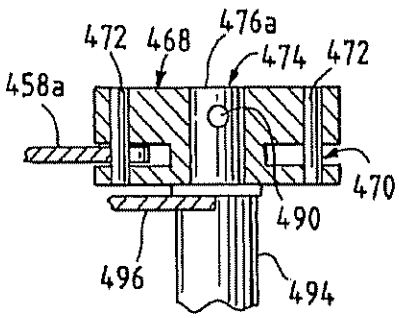


FIG. 16

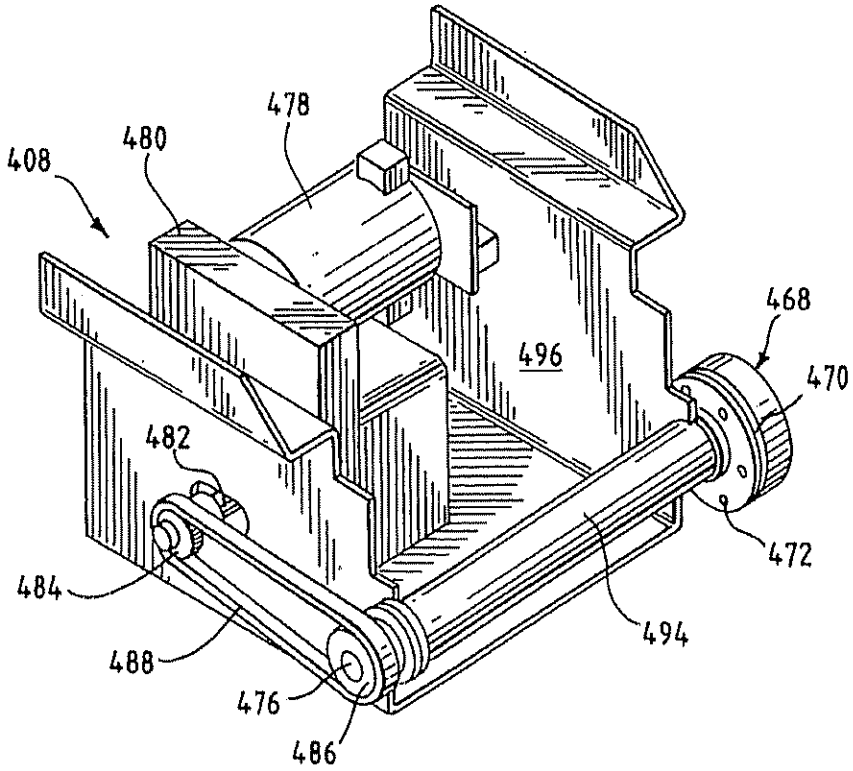


FIG. 17

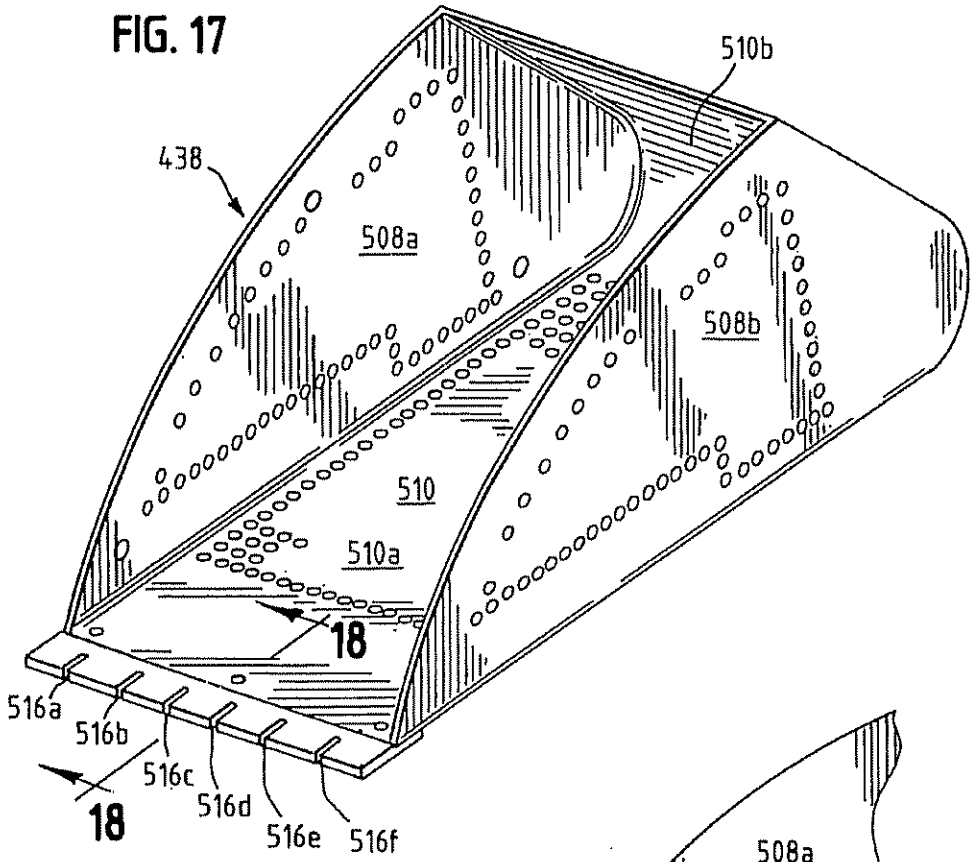


FIG. 18

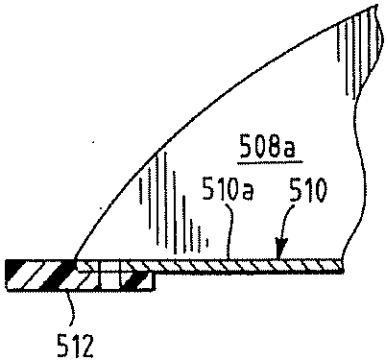


FIG. 19

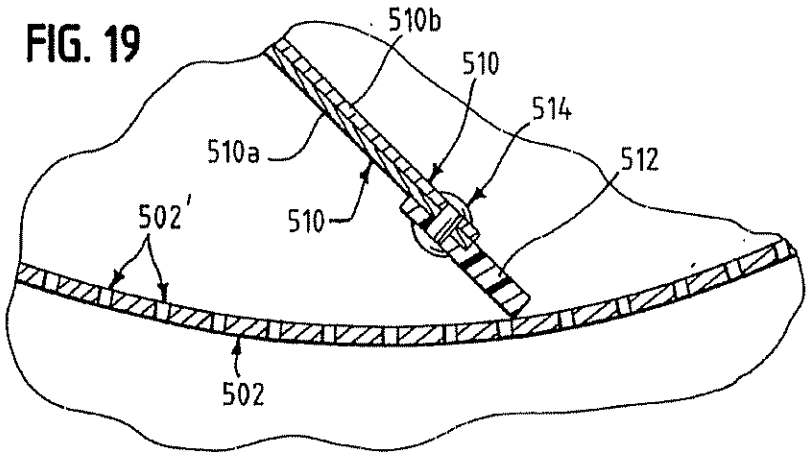


FIG. 20

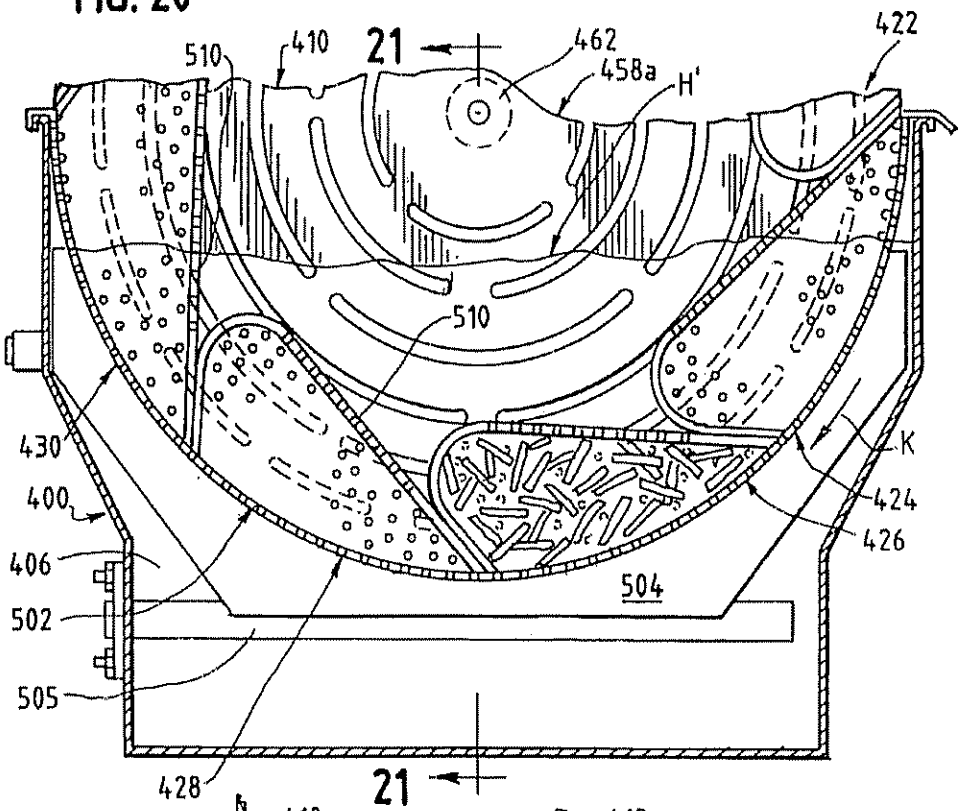


FIG. 21

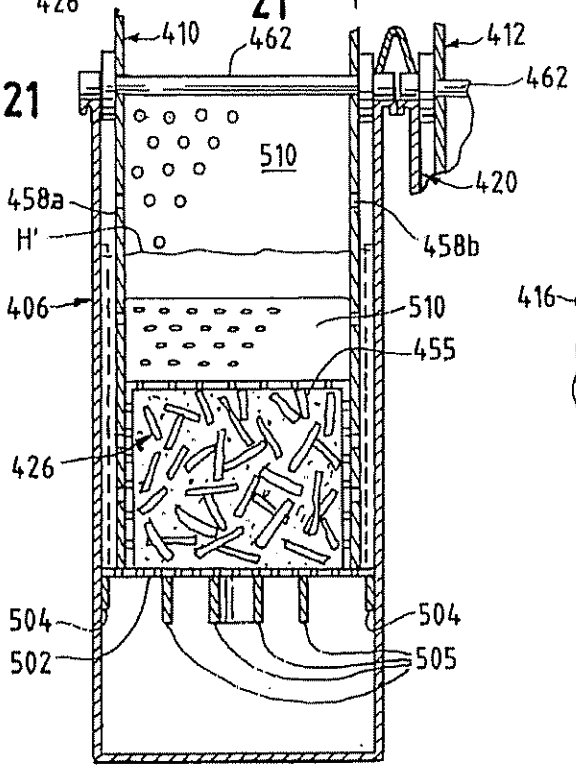


FIG. 22

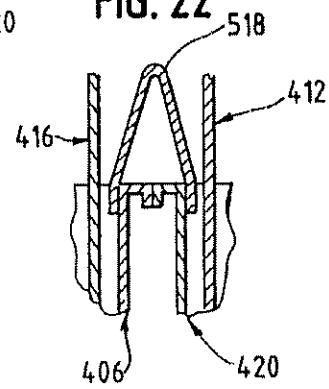


FIG. 23

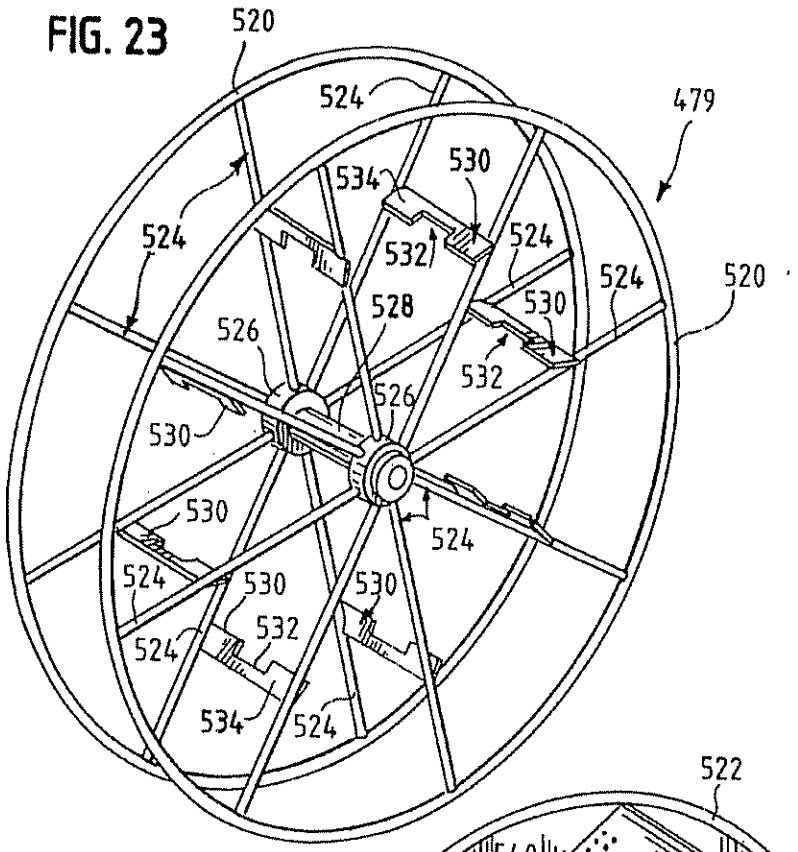

520
524
479
534
530
524
532
524
520
528
530
526
532
526
530
524
530
524
530
530
532
524
534
524

FIG. 24

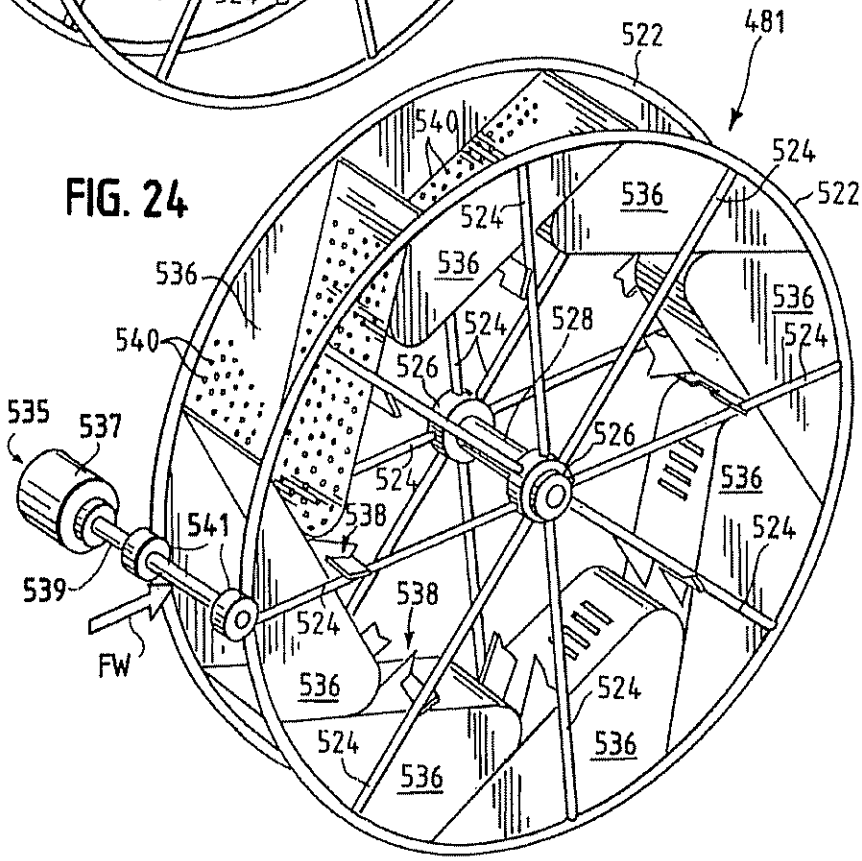

522
481
540
524
522
536
524
536
536
536
524
528
540
526
524
535
537
526
536
524
541
538
539
524
538
FW
536
524
524
536
536

FIG. 25

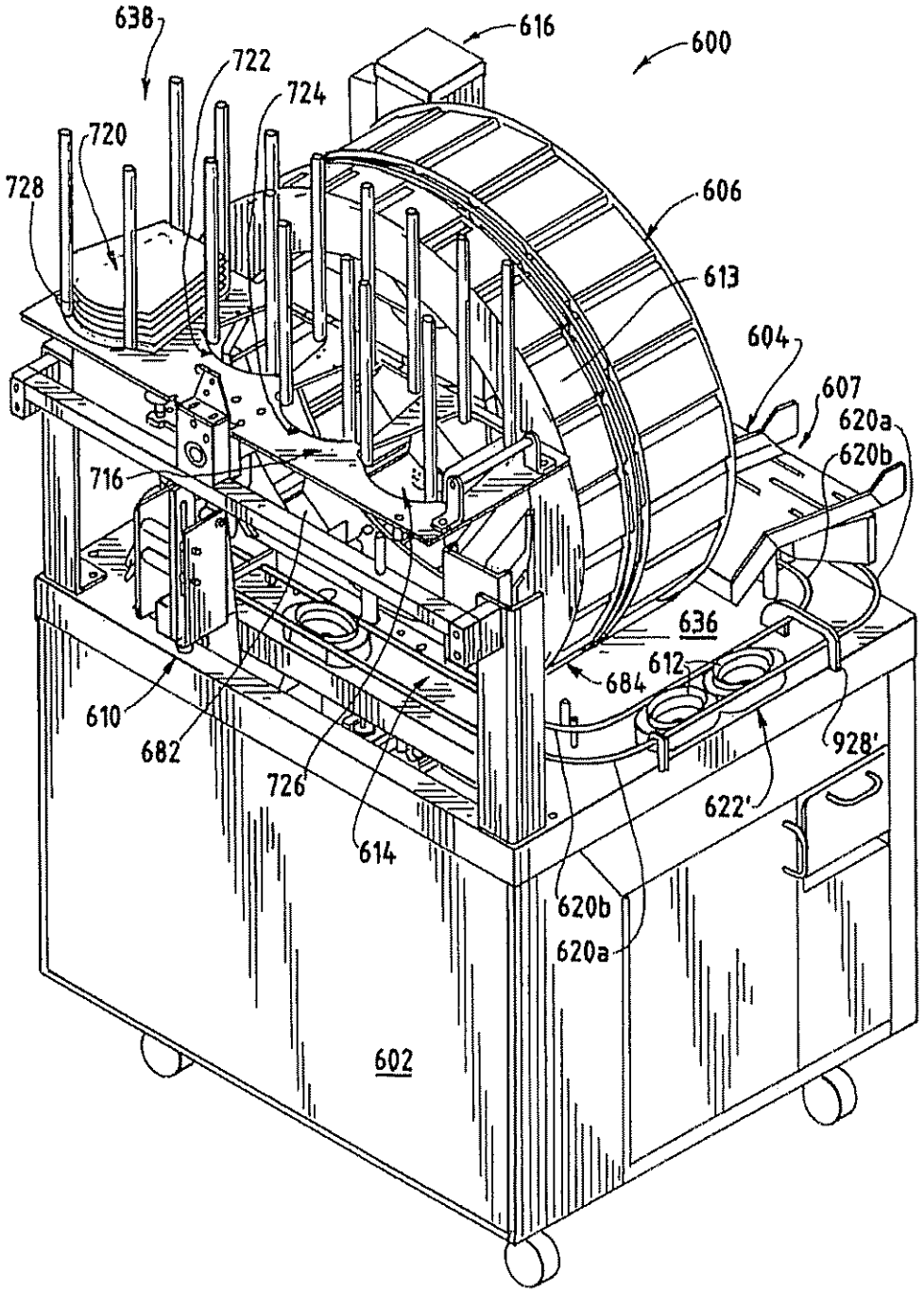

638
722
724
616
600
720
728
606
613
604
607
620a
620b
716
636
612
684
610
682
726
614
928'
622'
620b
620a
602

FIG. 26

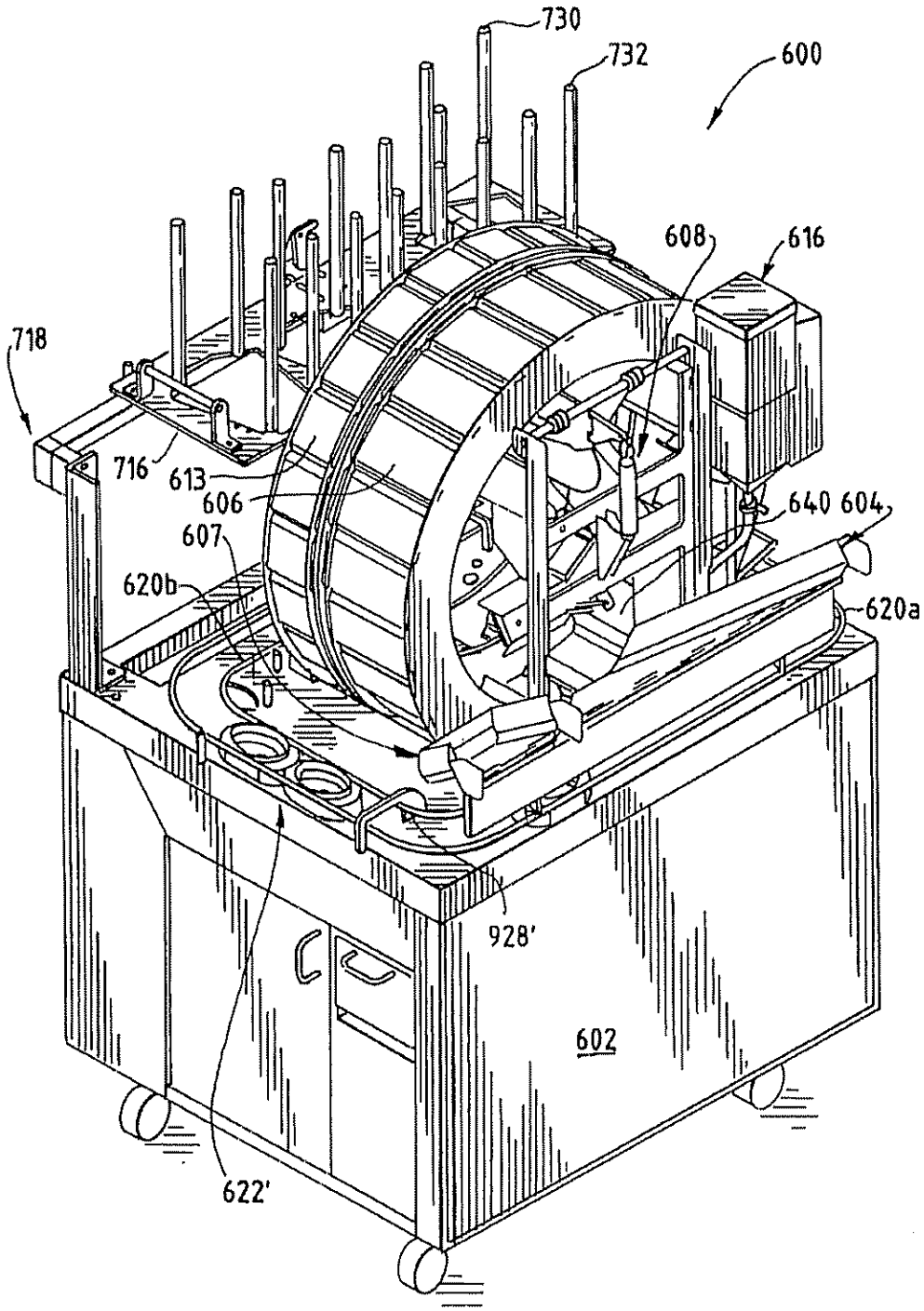

730
732
600
608
616
718
716
613
606
607
640 604
620b
620a
928'
602
622'

FIG. 27

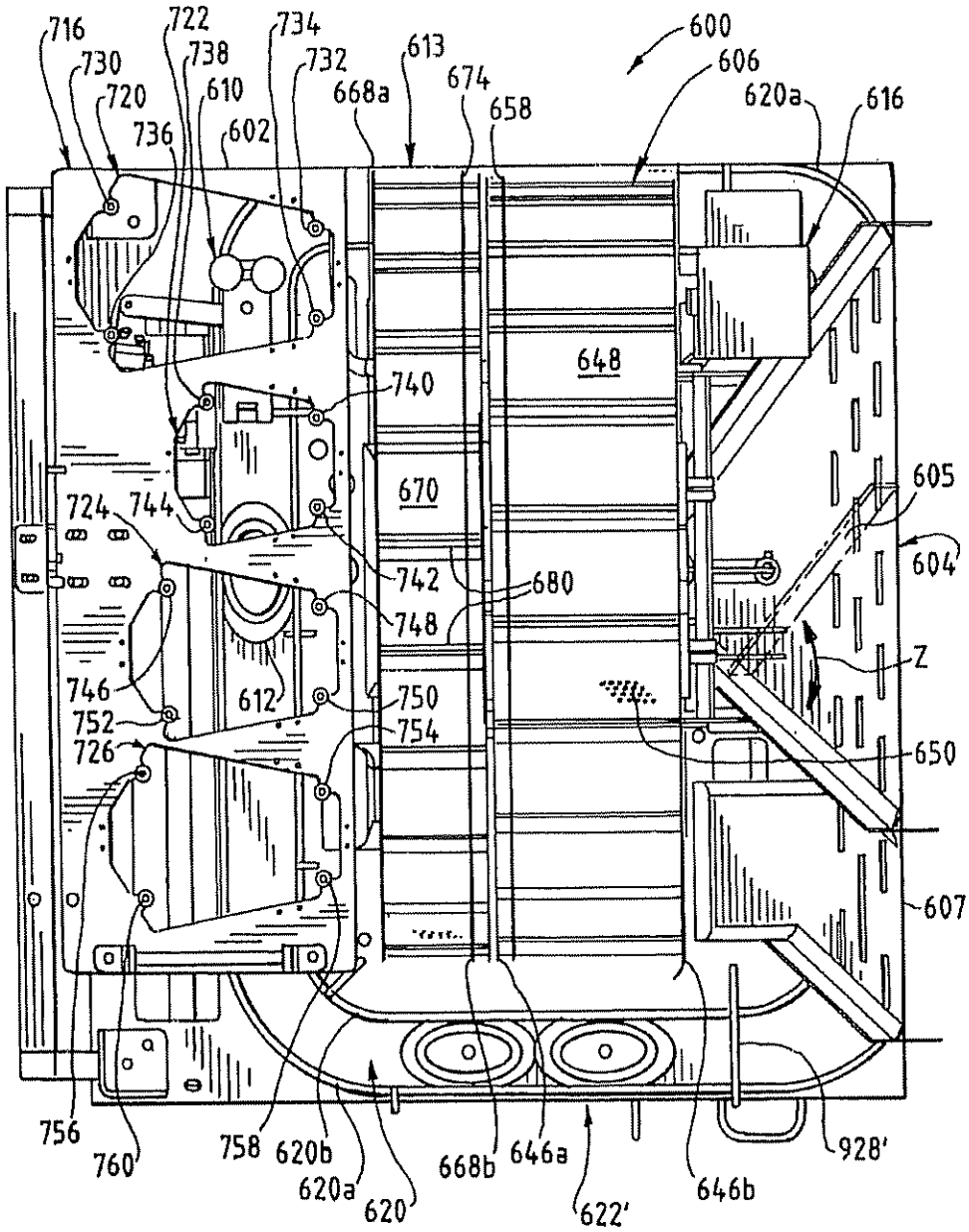

716
730
720
736
722
738
610
602
734
732
668a
613
674
658
600
606
620a
616
740
648
670
605
604
724
744
742
680
748
Z
746
752
726
612
750
754
650
607
756
760
758
620b
620a
620
668b
646a
622'
646b
928'

FIG. 28

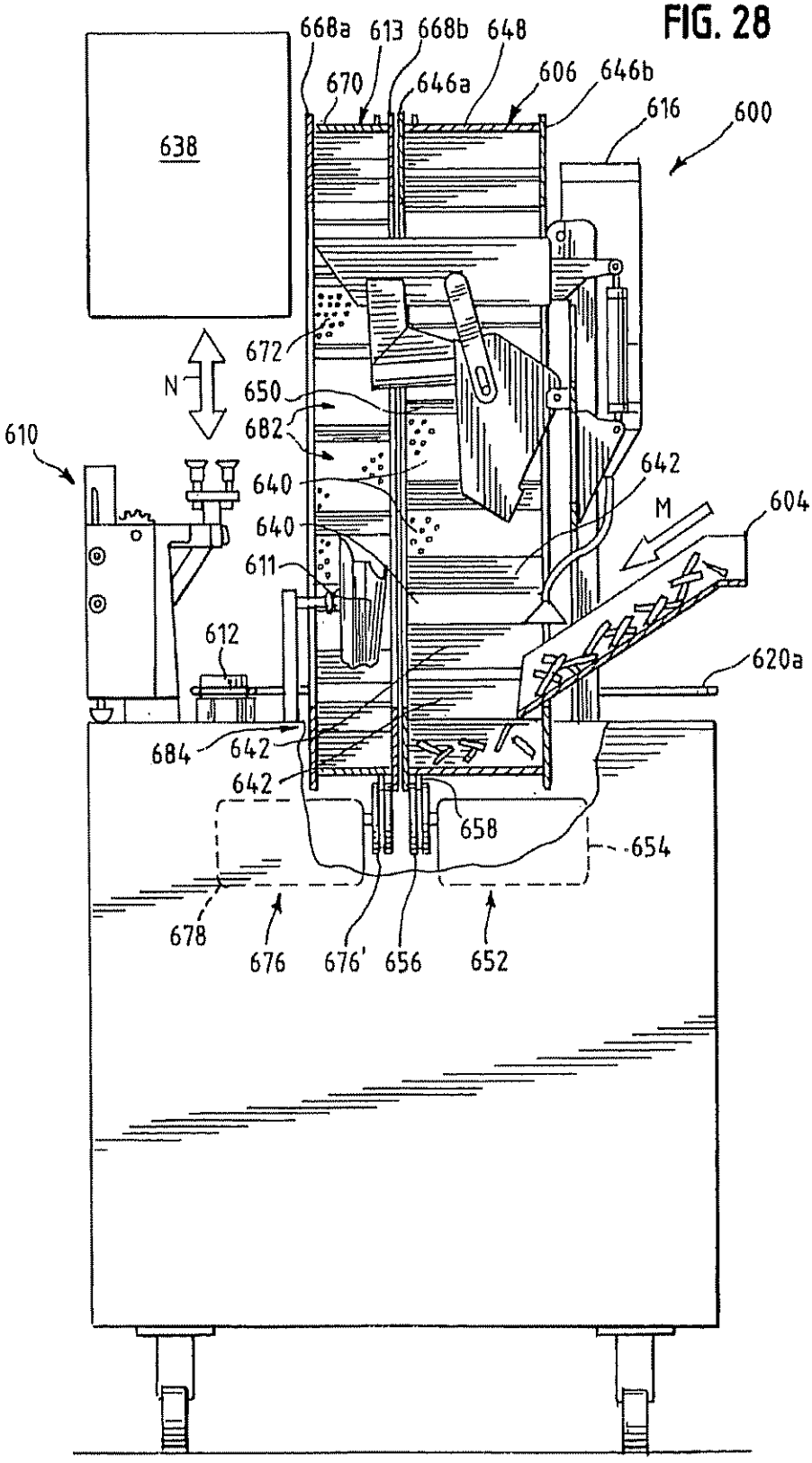

668a
613
668b
648
670
646a
606
646b
616
600
638
672
N
650
682
610
640
642
M
604
640
611
612
620a
684
642
642
658
654
678
676
676'
656
652

FIG. 29

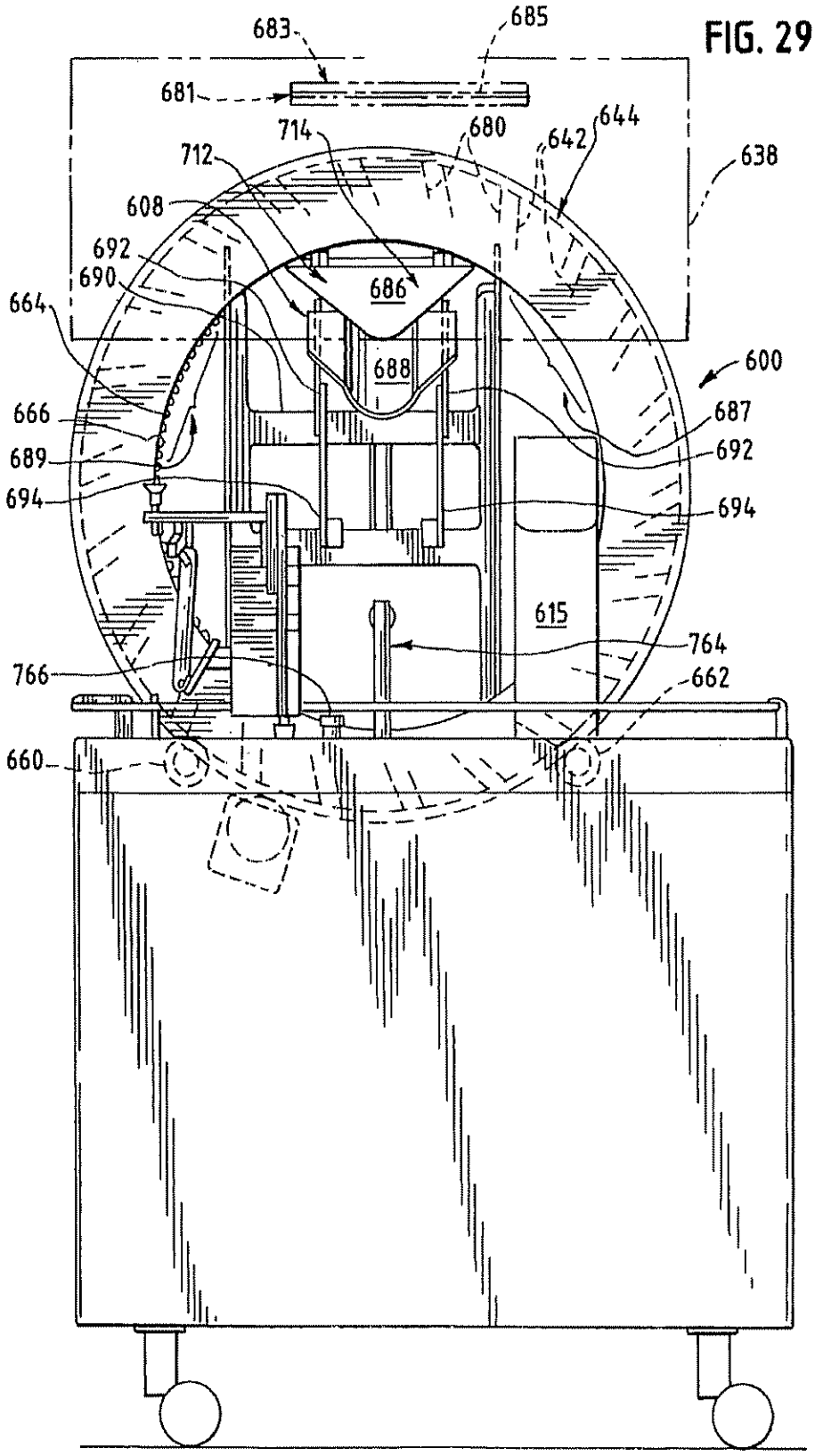

683
685
681
714
680
642
644
712
638
608
692
690
686
664
688
600
666
687
689
692
694
694
615
764
766
662
660

FIG. 30

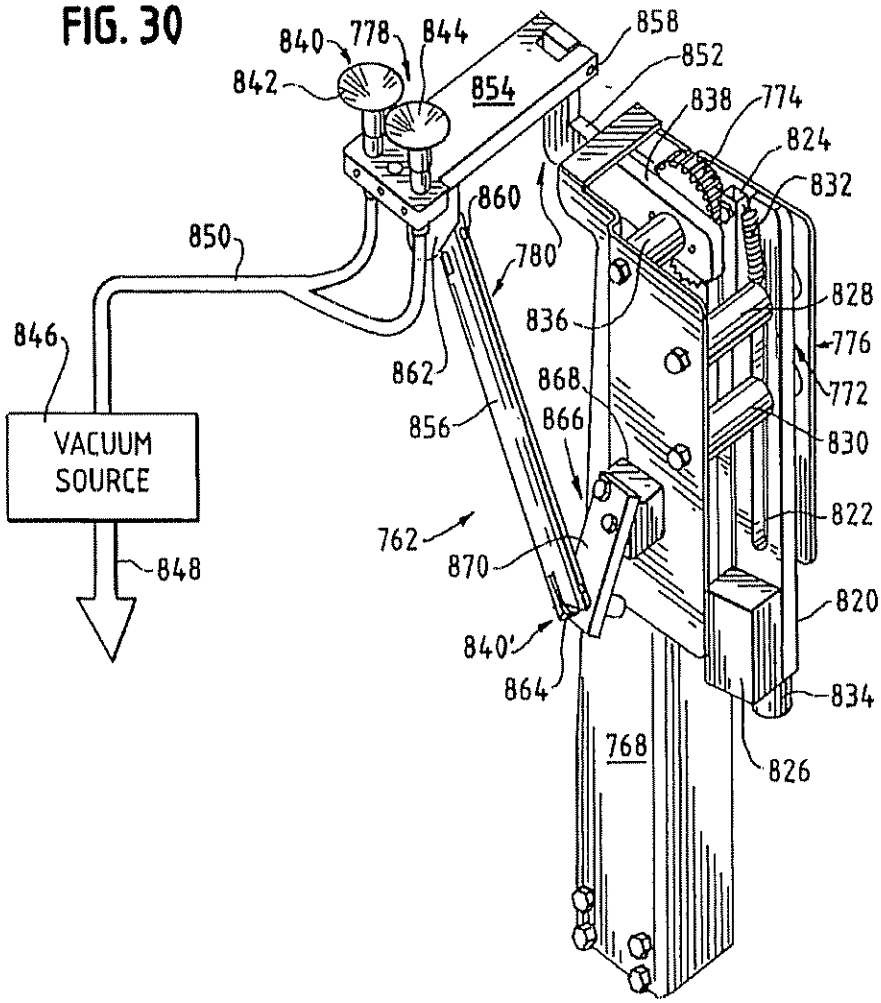

840
778
844
842
854
858
852
838
774
824
832
860
850
780
828
836
776
846
862
868
772
856
866
830
VACUUM SOURCE
762
822
870
848
820
840'
864
834
768
826

FIG. 31

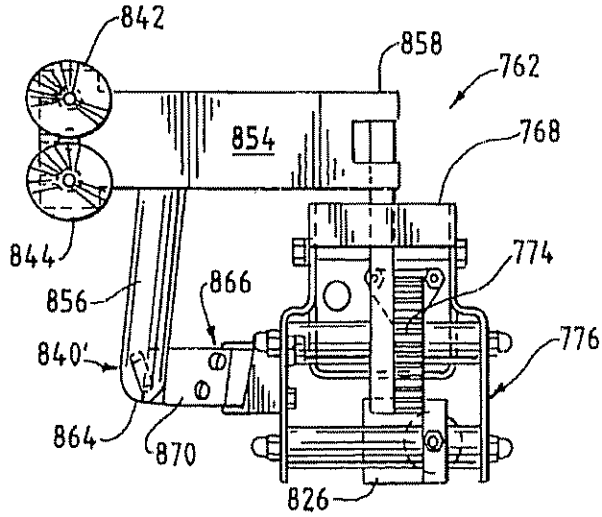

842
858
762
854
768
844
774
856
866
840'
776
864
870
826

FIG. 32

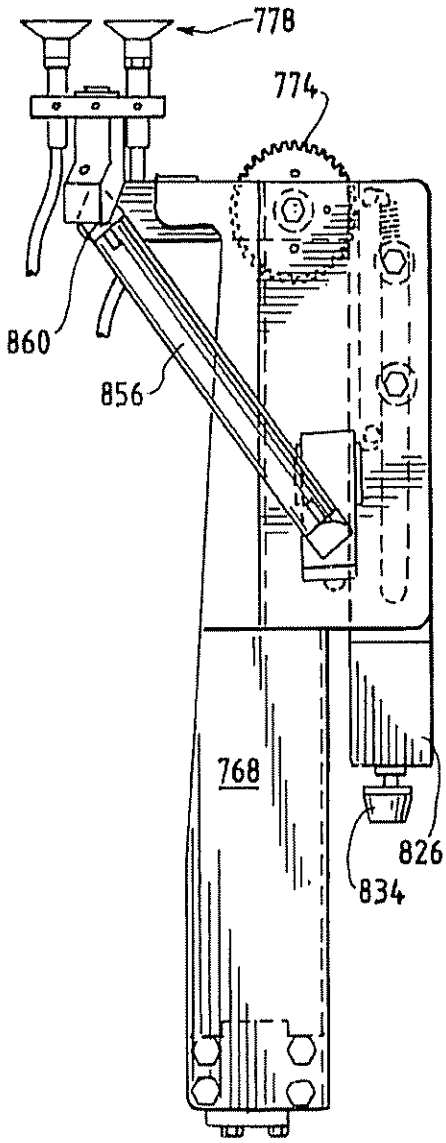

778
774
860
856
768
826
834

FIG. 33

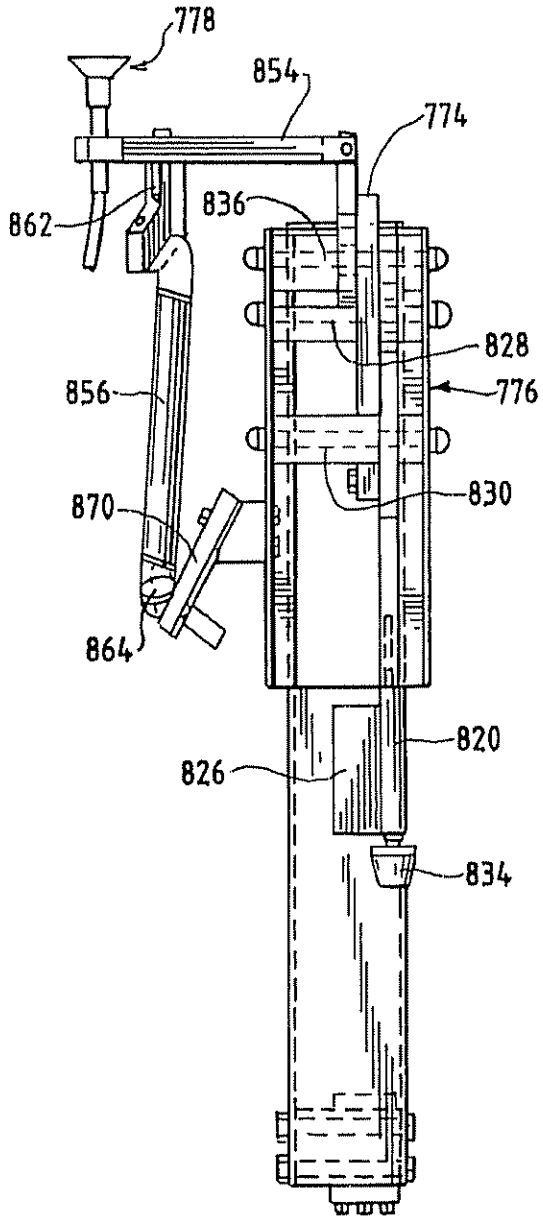

778
854
774
862
836
828
856
776
870
830
864
820
826
834

FIG. 34

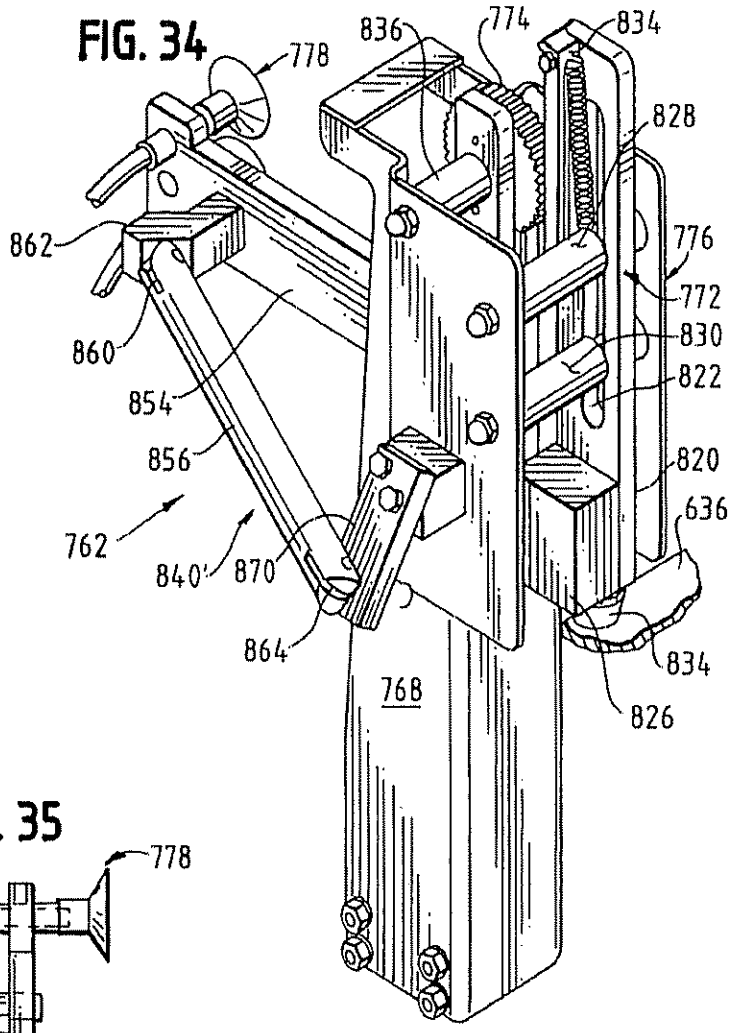

778
836
774
834
828
862
776
772
860
830
854
822
856
820
636
762
840'
870
864
834
768
826

FIG. 35

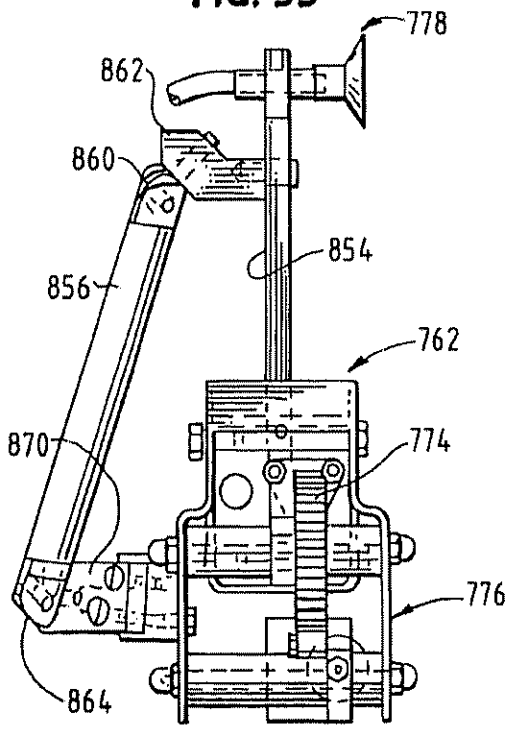

778
862
860
854
856
762
870
774
776
864

FIG. 36

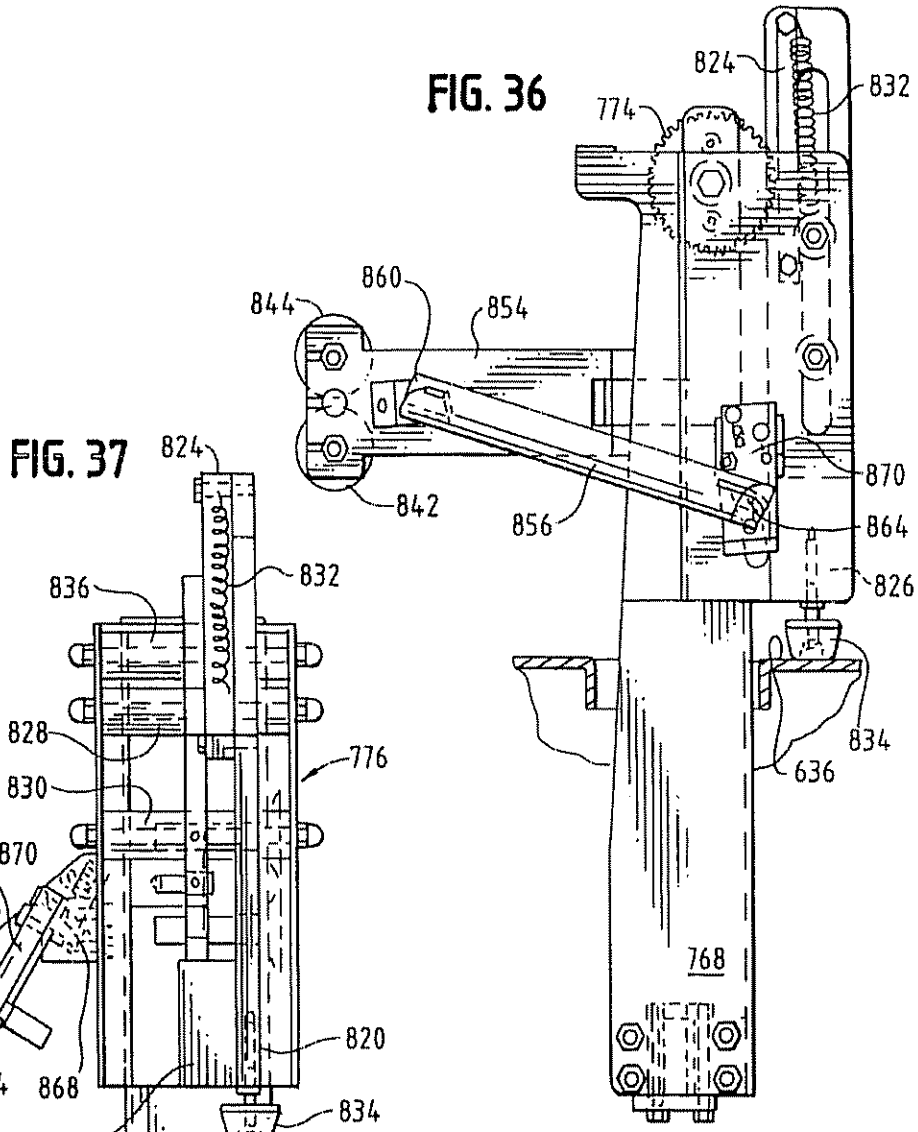

824
832
774
860
844
854
870
842
856
864
826
834
636
768

FIG. 37

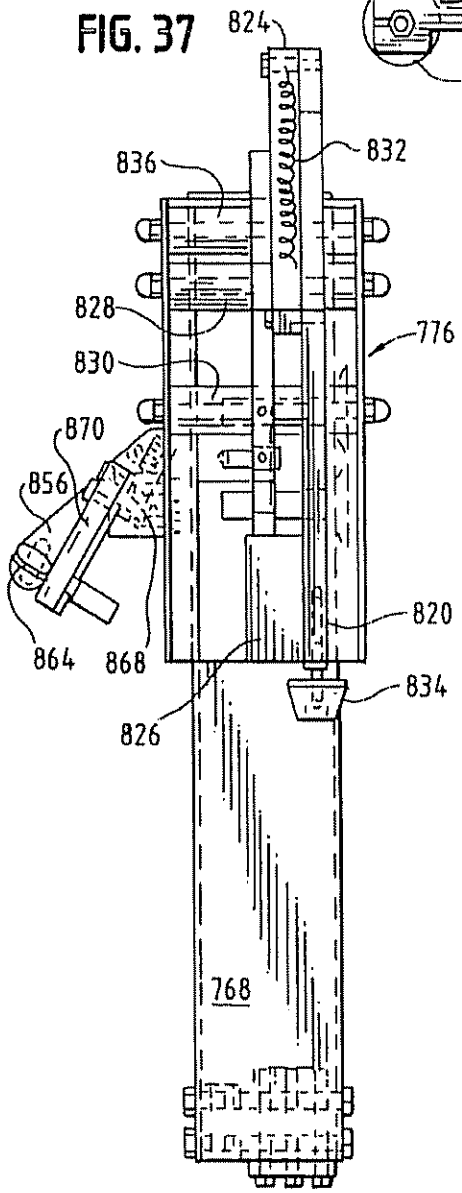
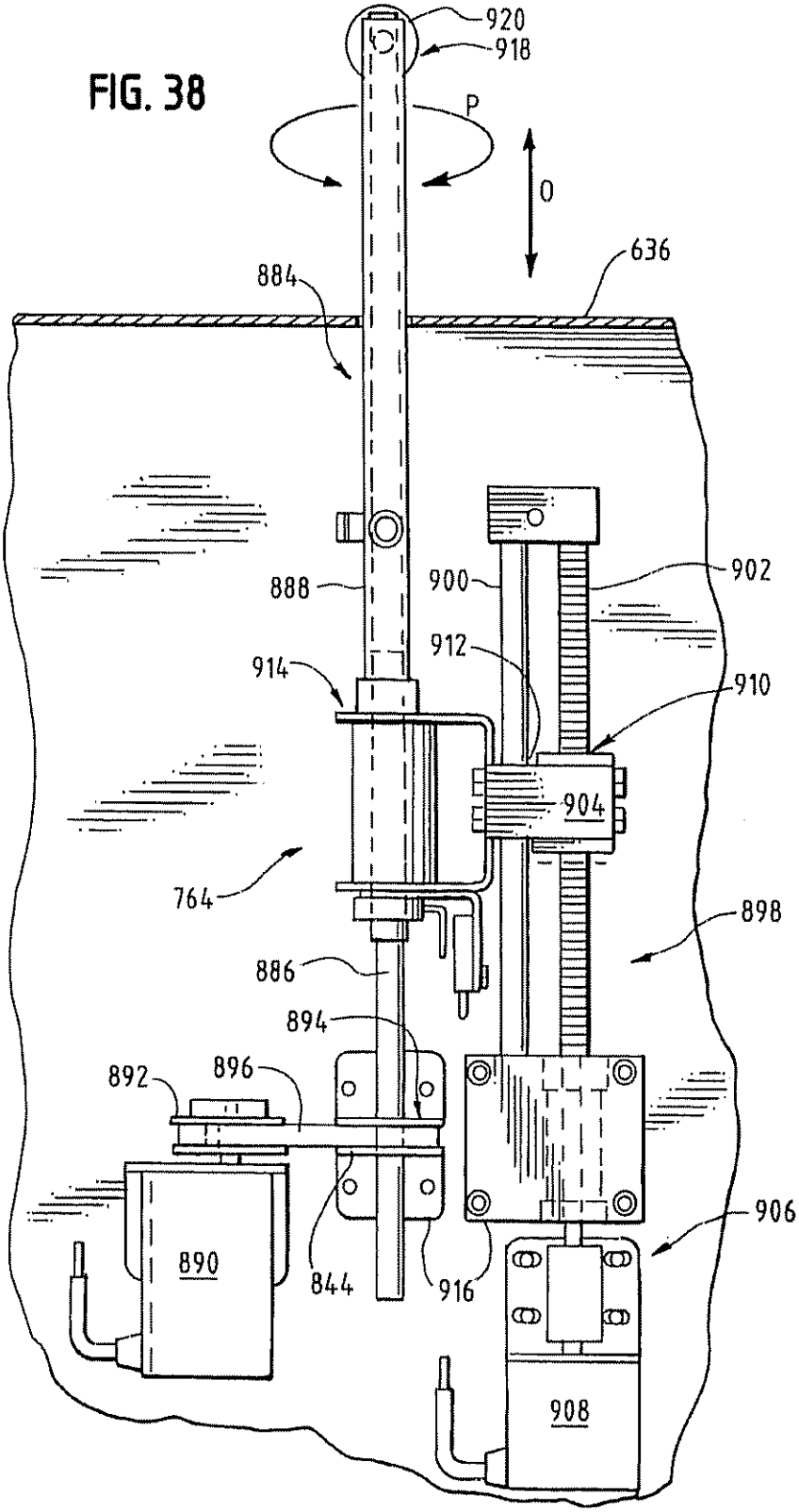

824
836
832
828
776
830
870
856
820
864
868
834
826
768

FIG. 38


920
918
P
O
636
884
888
900
902
912
914
910
904
764
898
886
894
892
896
890
844
916
906
908

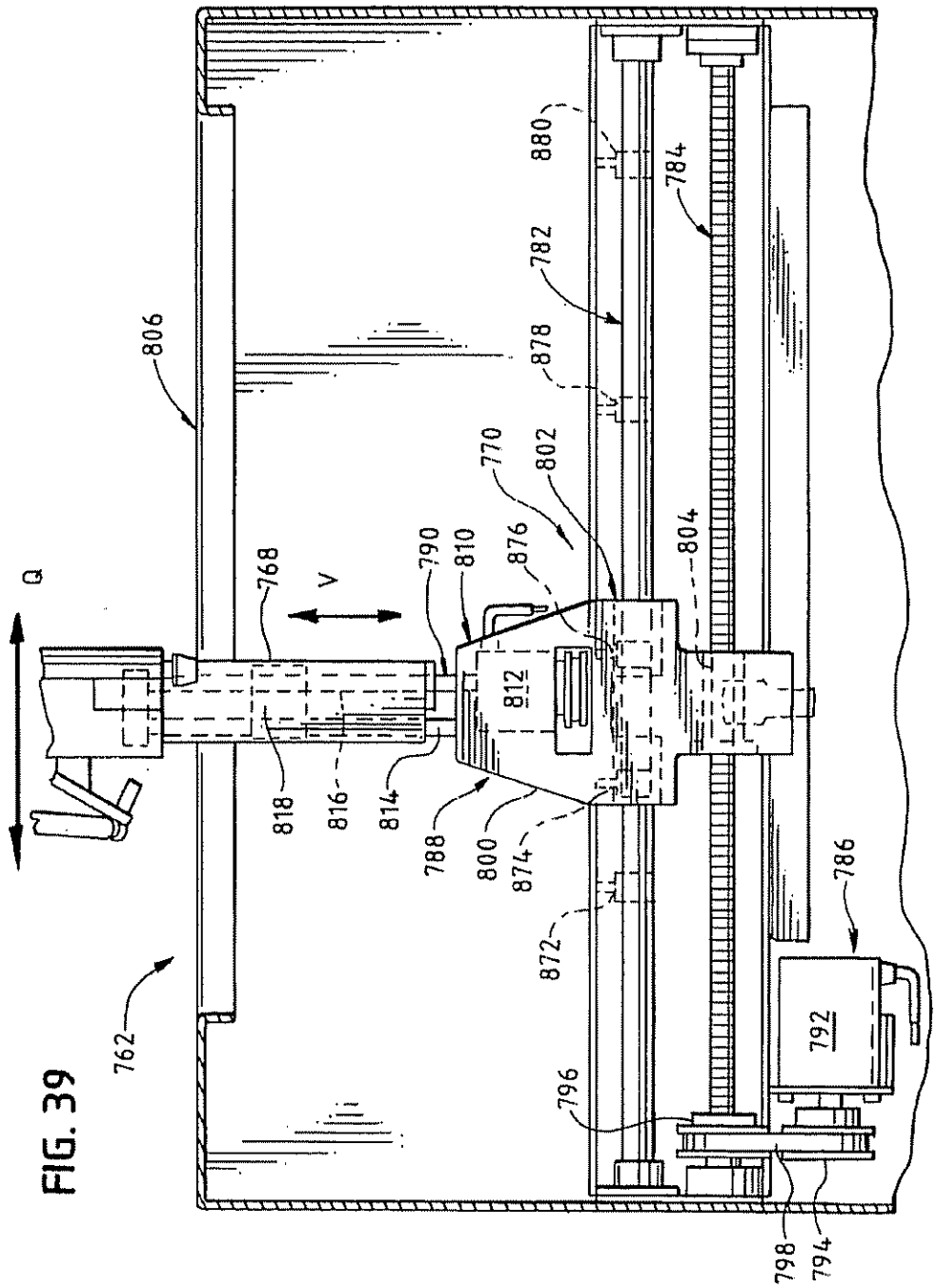

880
784
782
878
806
770
802
804
876
790
810
768
V
Q
812
818
816
814
788
800
874
872
786
792
762
796
798
794

FIG. 39

FIG. 40

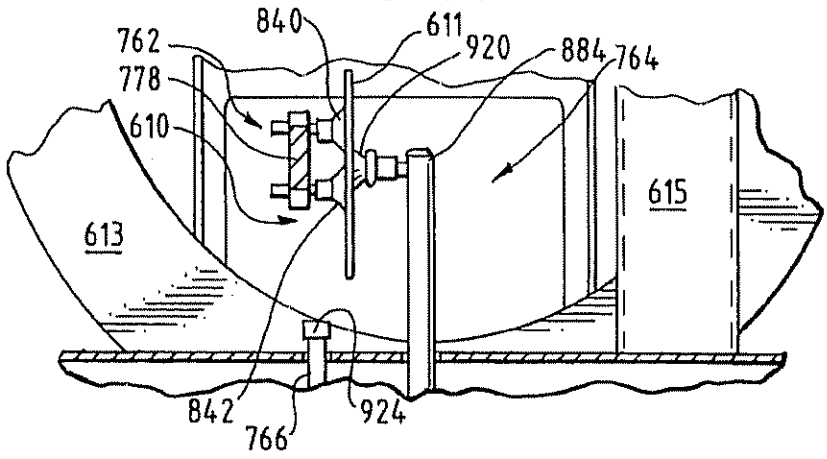


FIG. 41

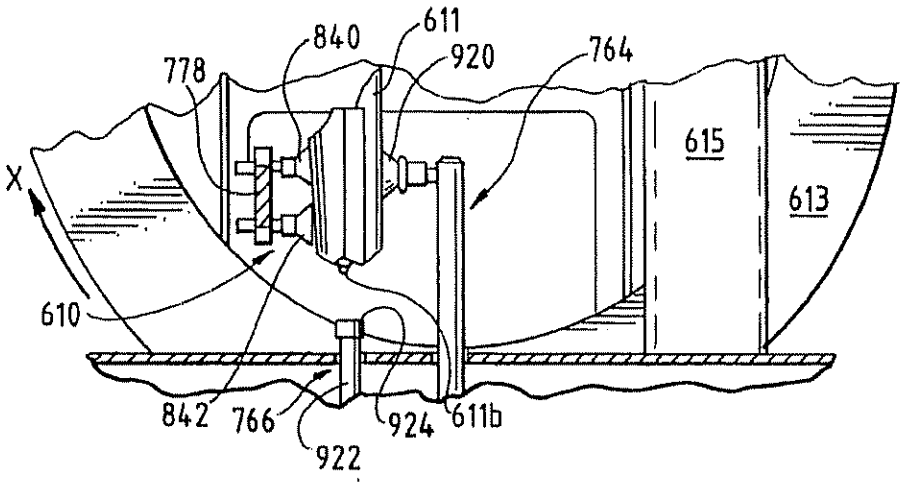


FIG. 42

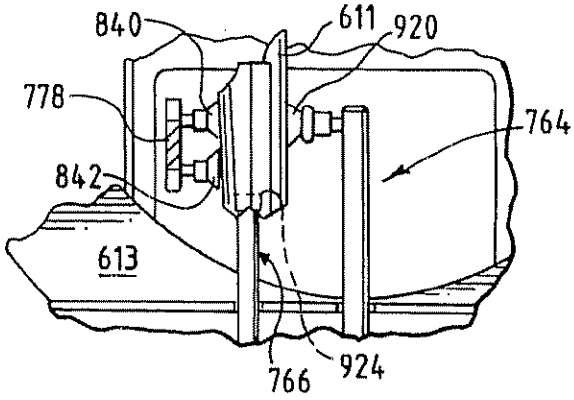


FIG. 43

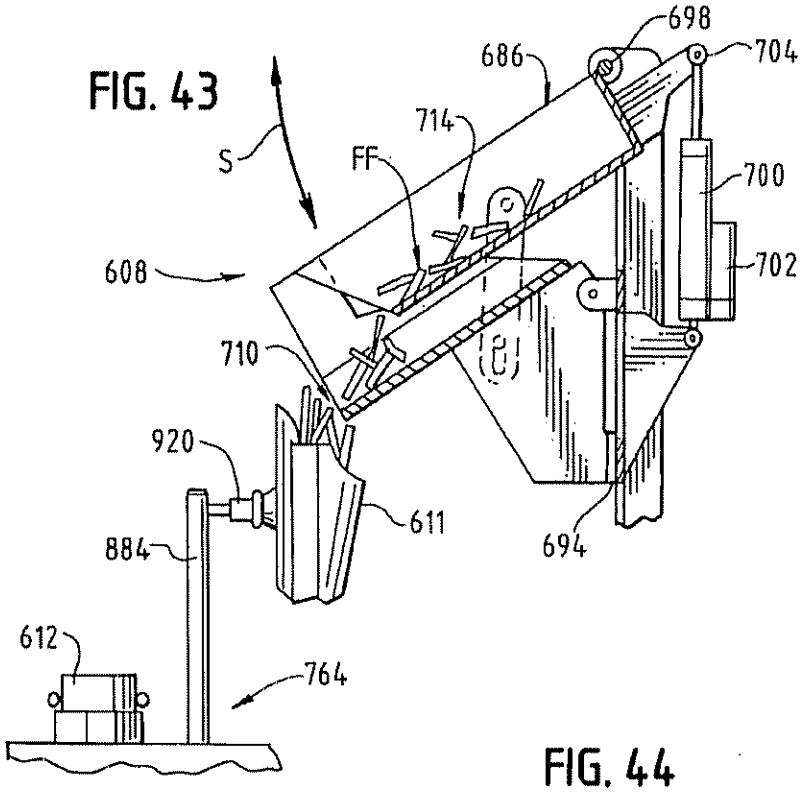

698
686
704
714
S
FF
700
608
702
710
920
611
884
694
612
764

FIG. 44

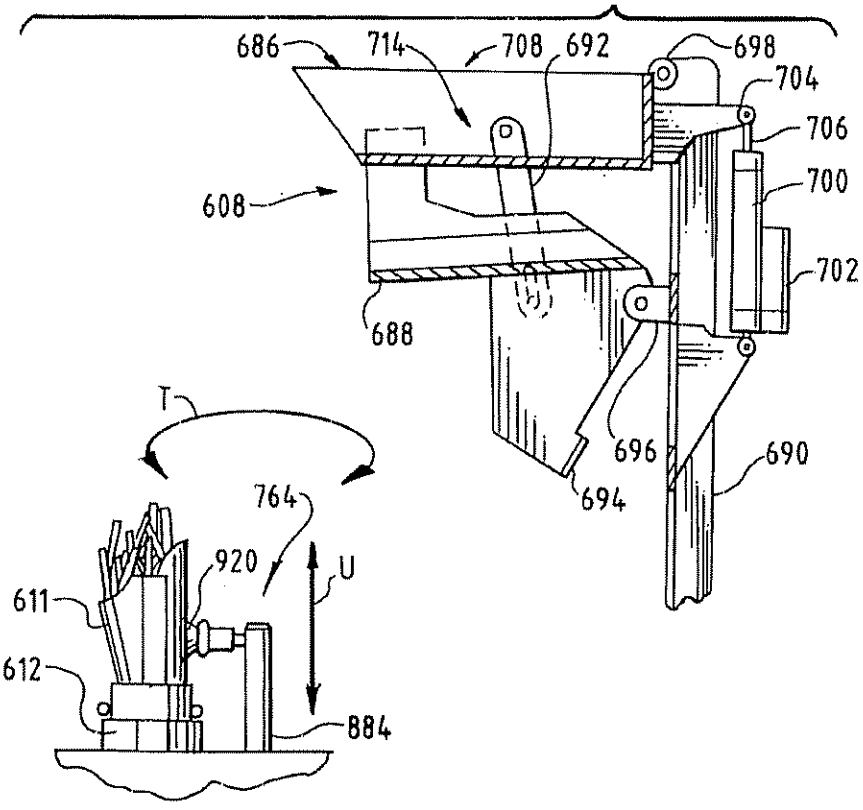

686
714
708
692
698
704
706
608
700
702
688
T
696
690
694
764
920
U
611
612
884

FIG. 45

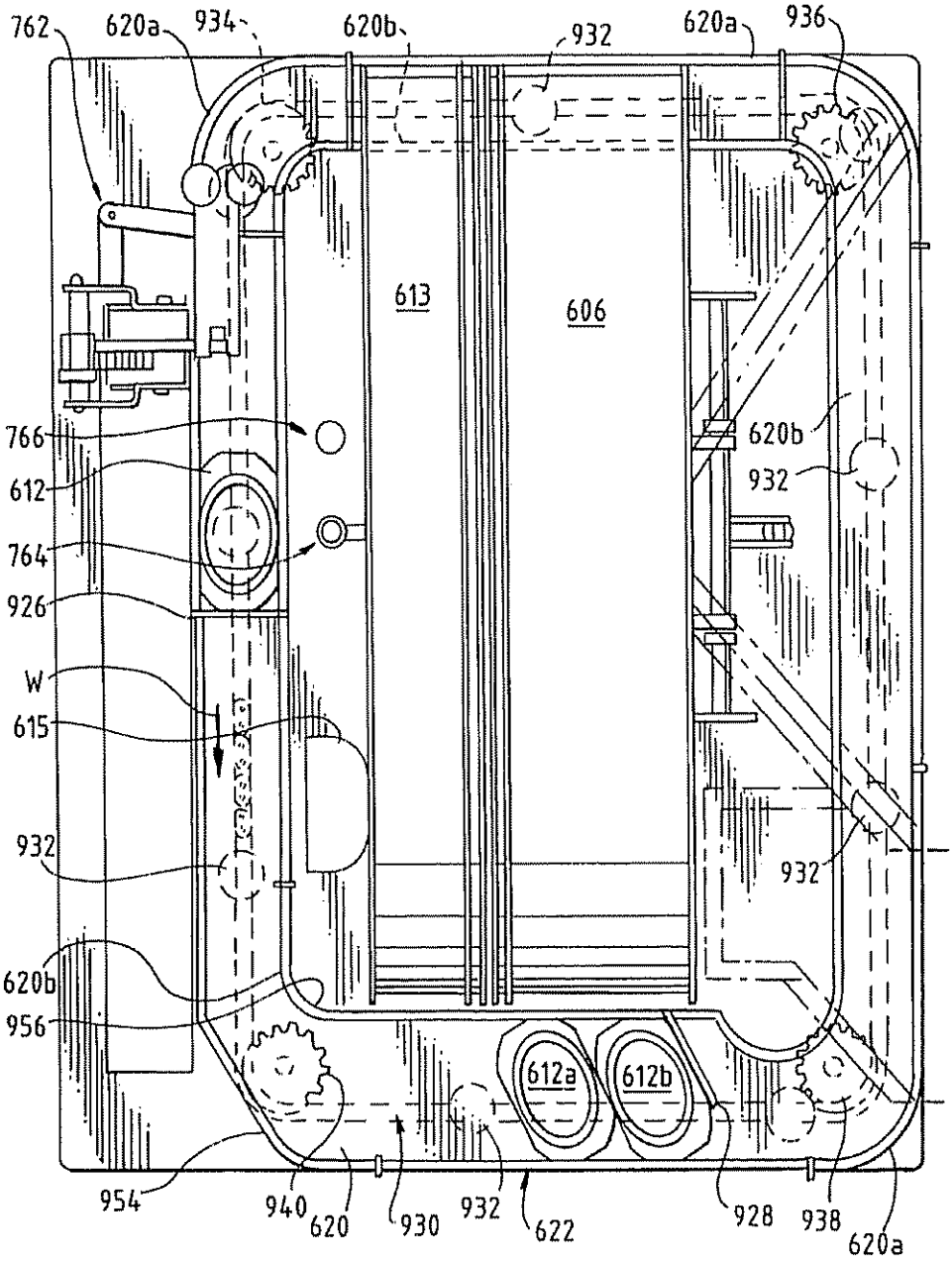

762
620a
934
620b
932
620a
936
613
606
766
612
764
926
W
615
932
620b
956
954
940
620
930
932
622
612a
612b
928
938
620a
620b
932
932

FIG. 46

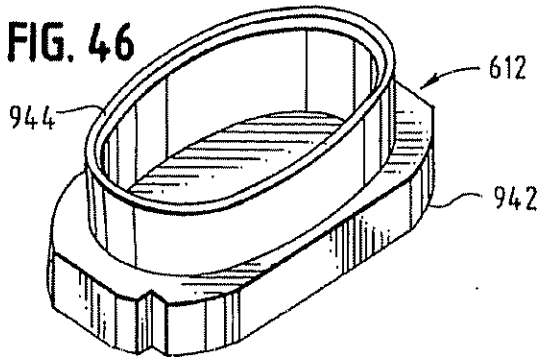


FIG. 47

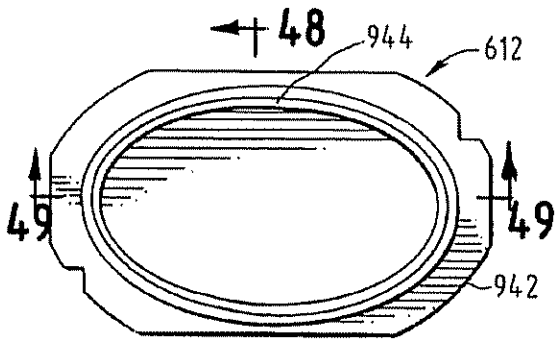


FIG. 48

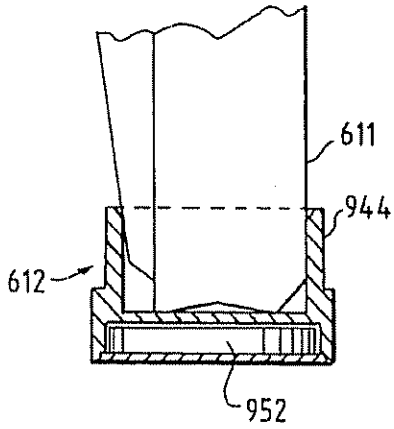


FIG. 49

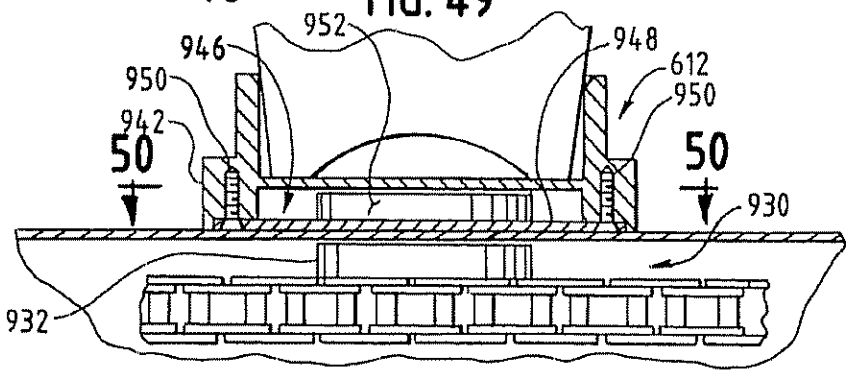


FIG. 50

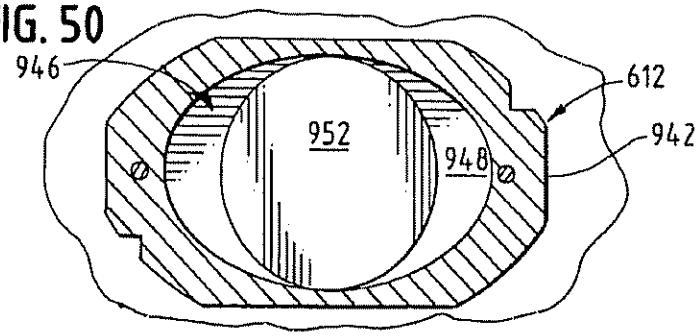


FIG. 51

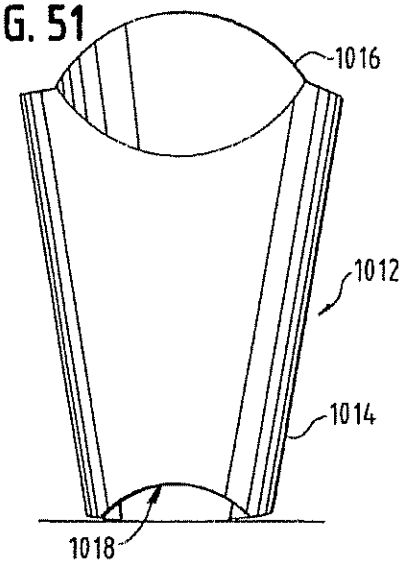


FIG. 52

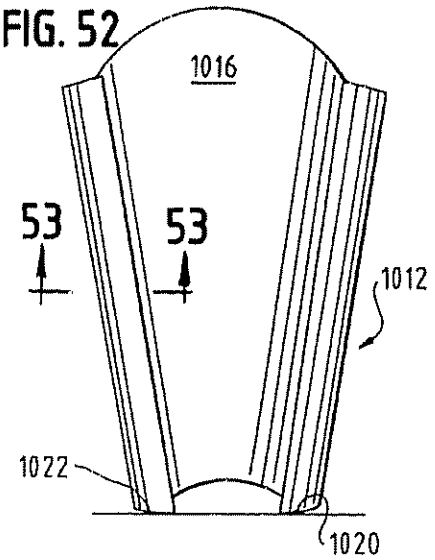


FIG. 53

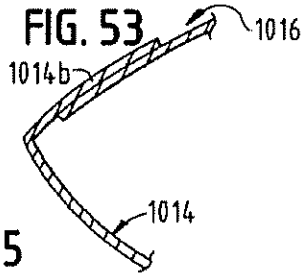


FIG. 54

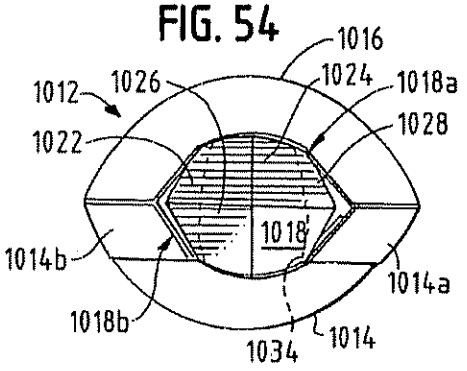


FIG. 55

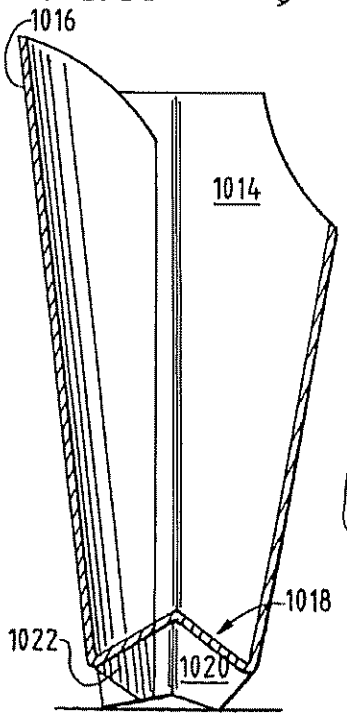


FIG. 56

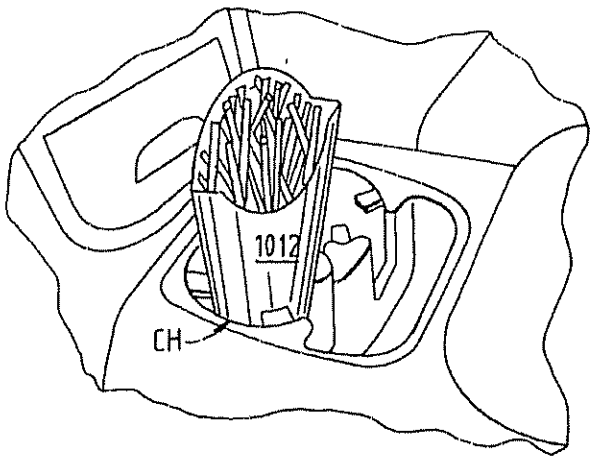


FIG. 57

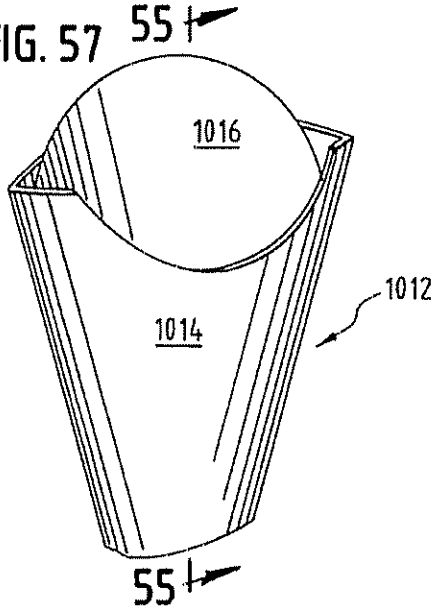


FIG. 58

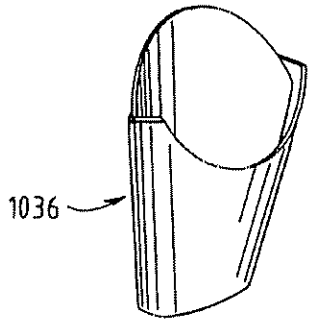


FIG. 59

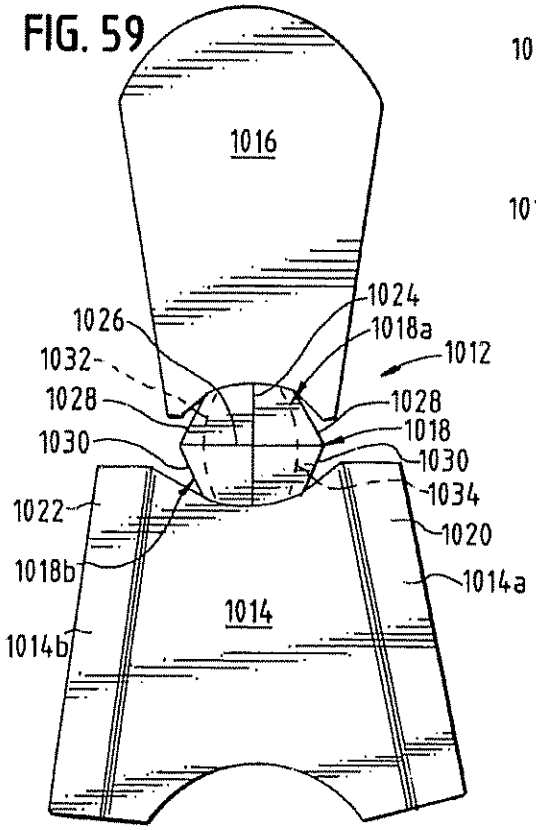


FIG. 60

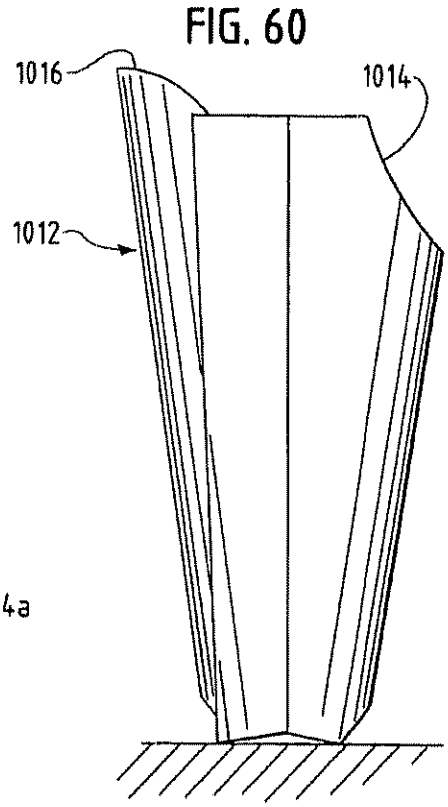


FIG. 61

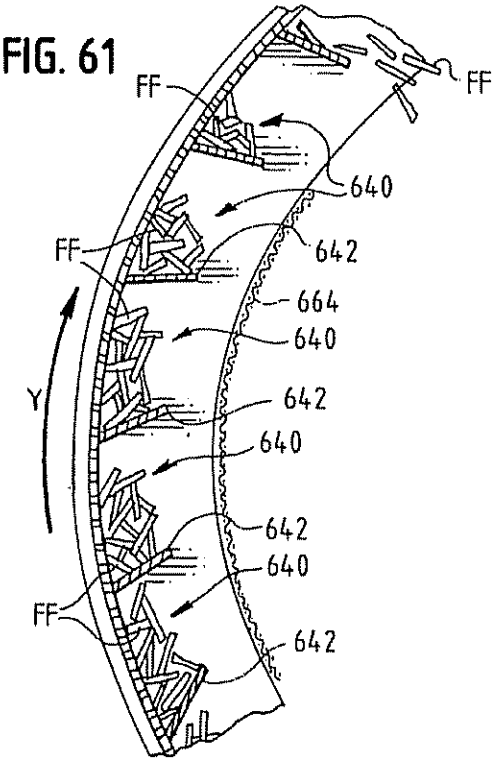


FIG. 62

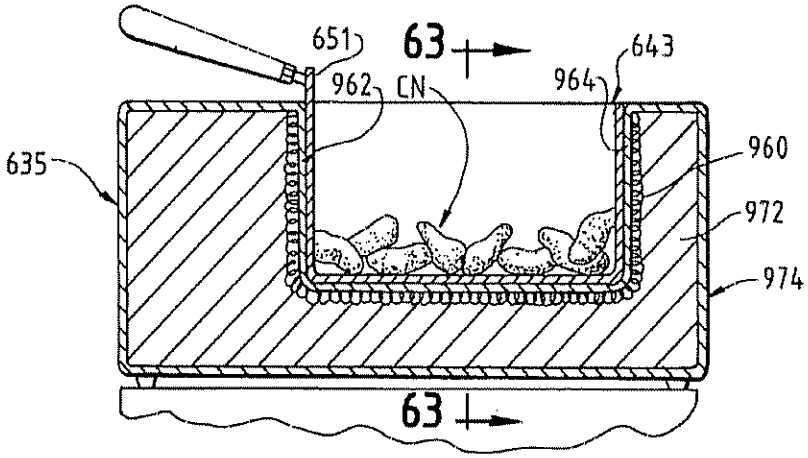


FIG. 63

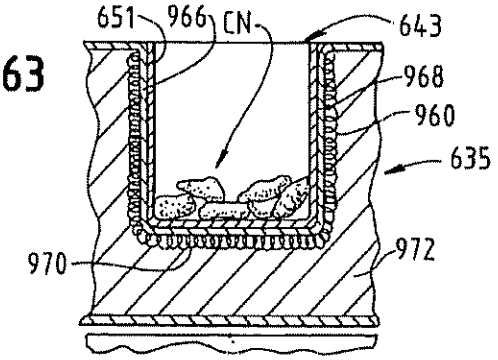


FIG. 64

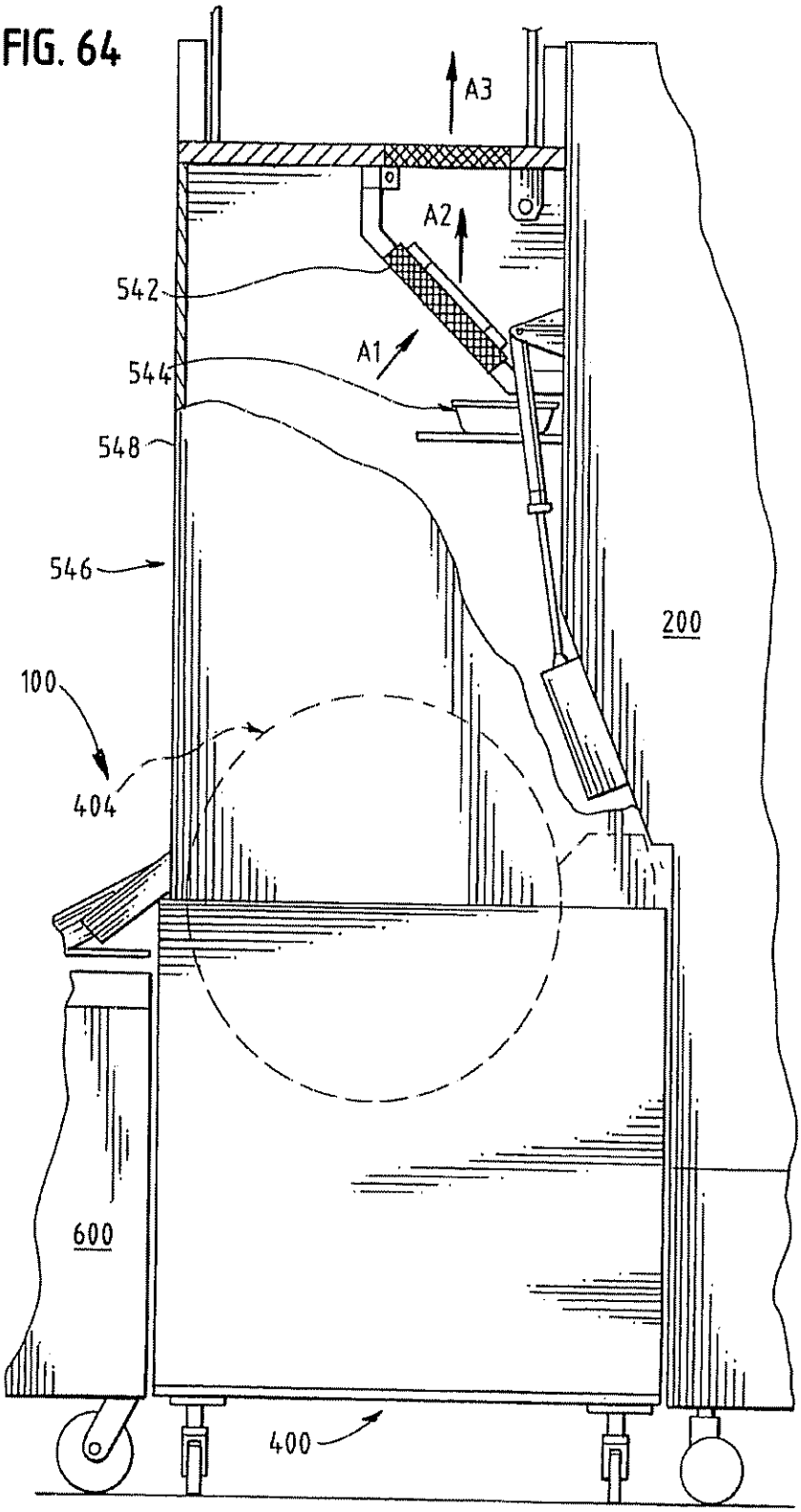


FIG. 65

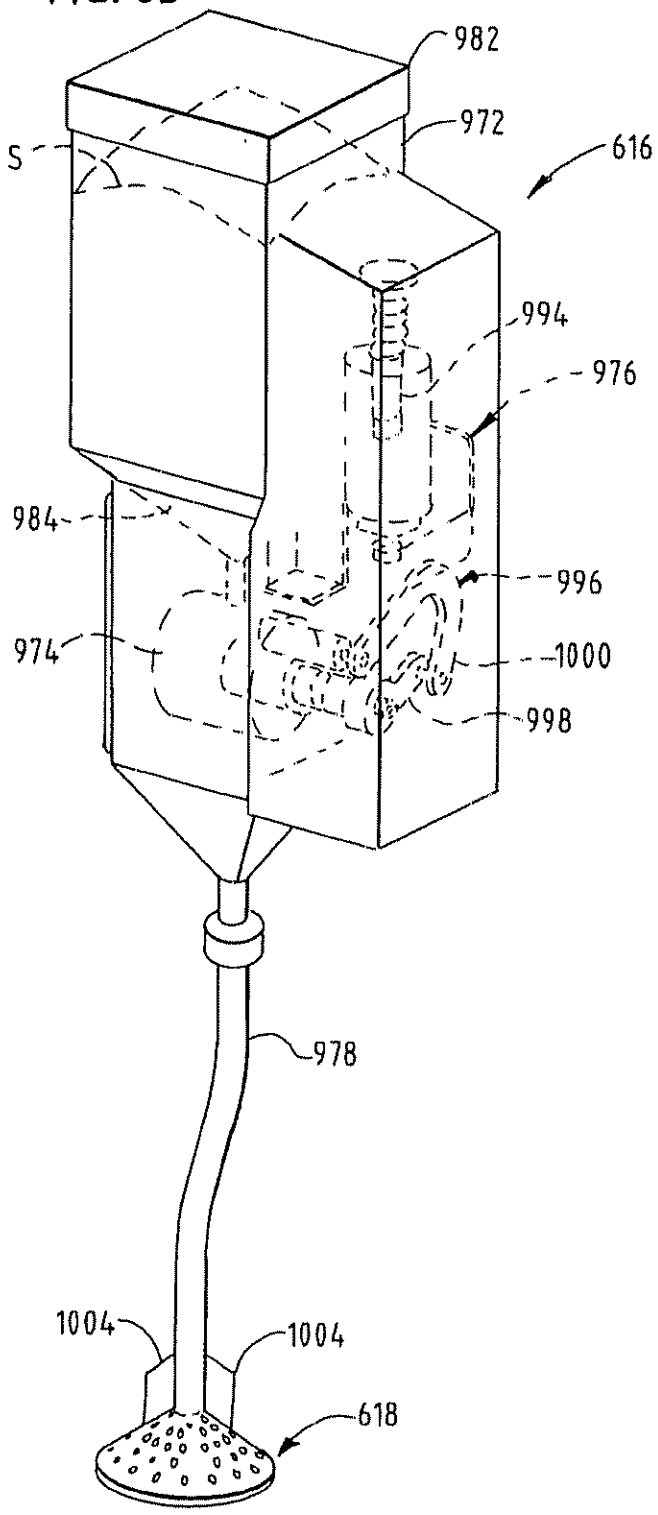


FIG. 66

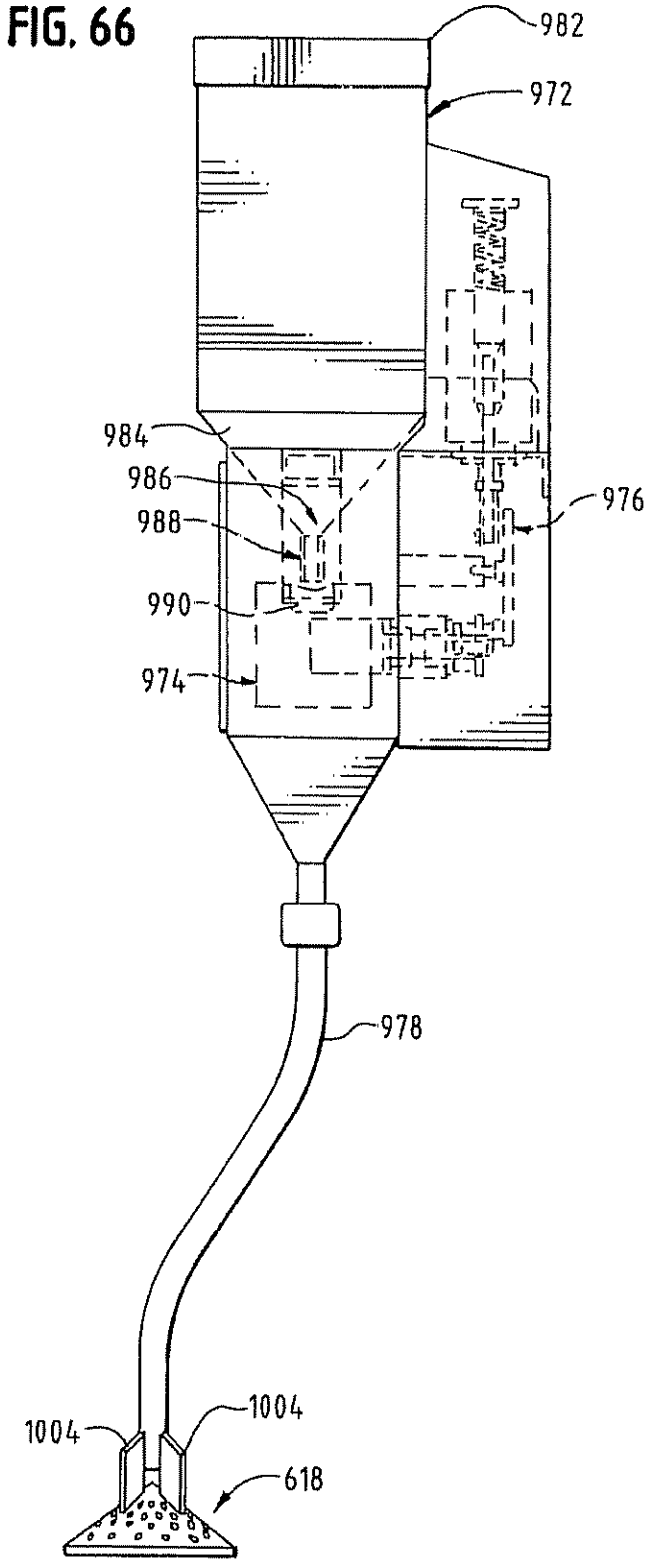


FIG. 67

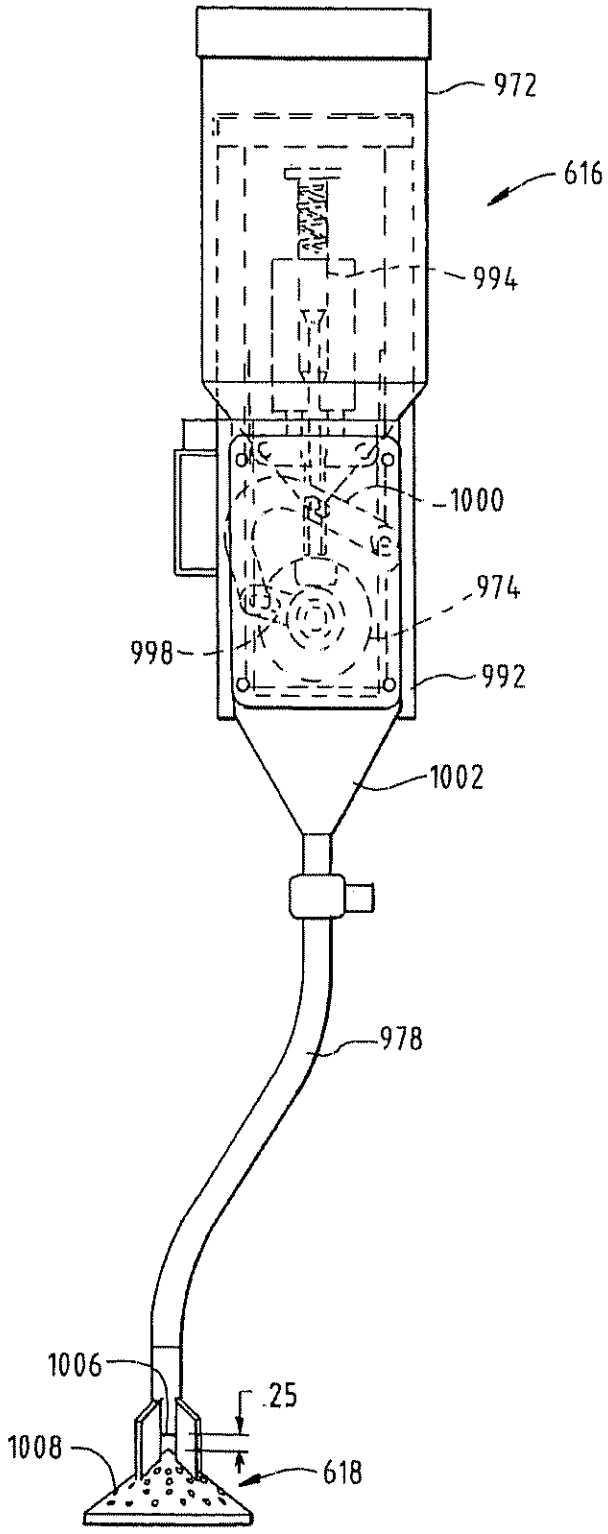


FIG. 68

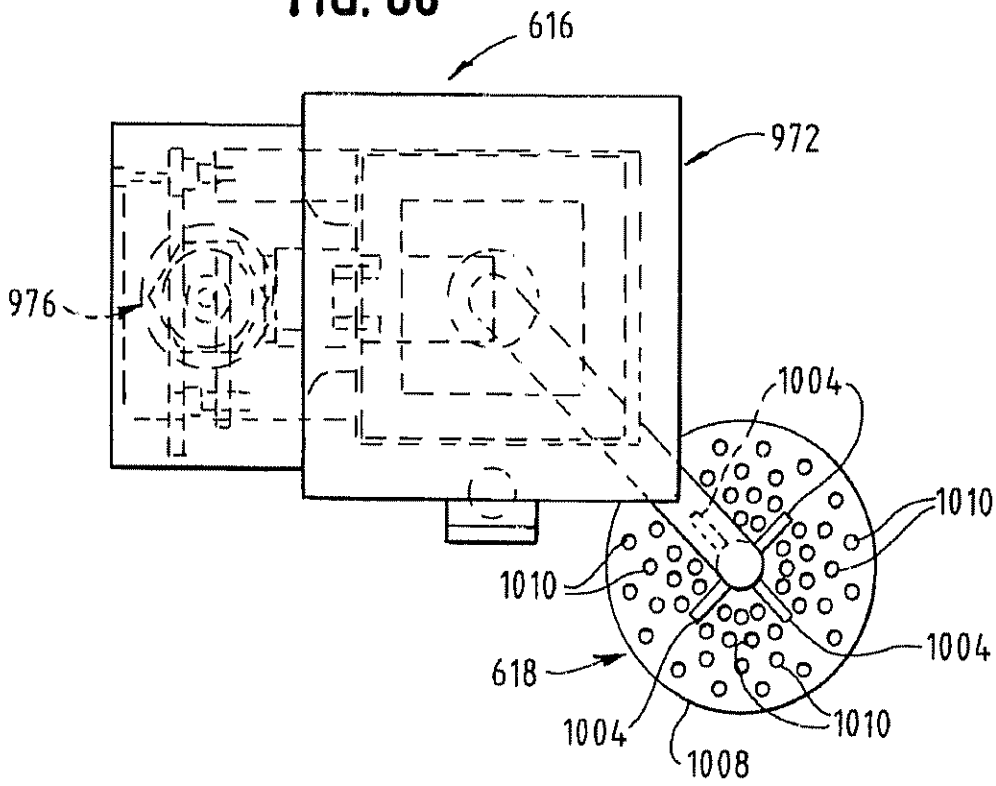


FIG. 69

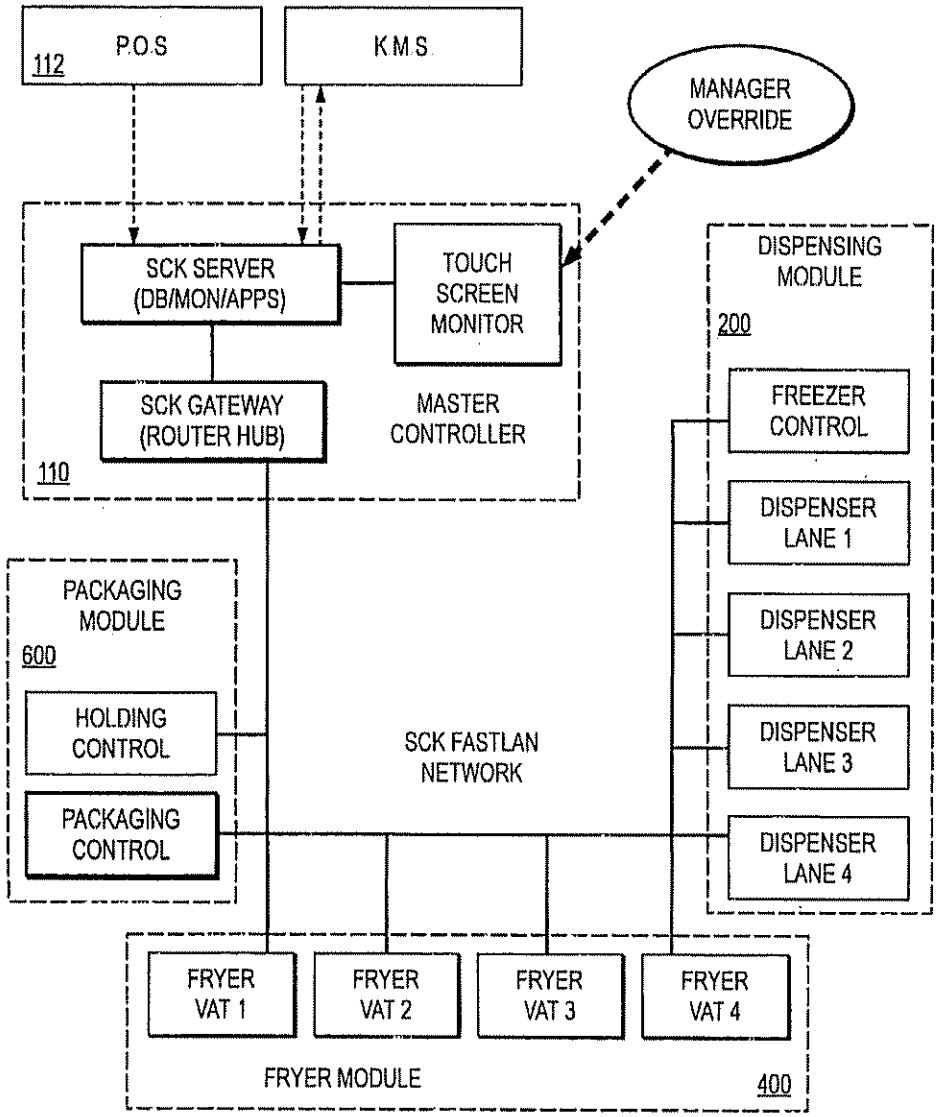

P.O.S
112
K.M.S
MANAGER OVERRIDE
SCK SERVER (DB/MON/APPS)
TOUCH SCREEN MONITOR
SCK GATEWAY (ROUTER HUB)
MASTER CONTROLLER
110
DISPENSING MODULE
200
FREEZER CONTROL
DISPENSER LANE 1
DISPENSER LANE 2
DISPENSER LANE 3
DISPENSER LANE 4
PACKAGING MODULE
600
HOLDING CONTROL
PACKAGING CONTROL
SCK FASTLAN NETWORK
FRYER VAT 1
FRYER VAT 2
FRYER VAT 3
FRYER VAT 4
FRYER MODULE
400

FIG. 70

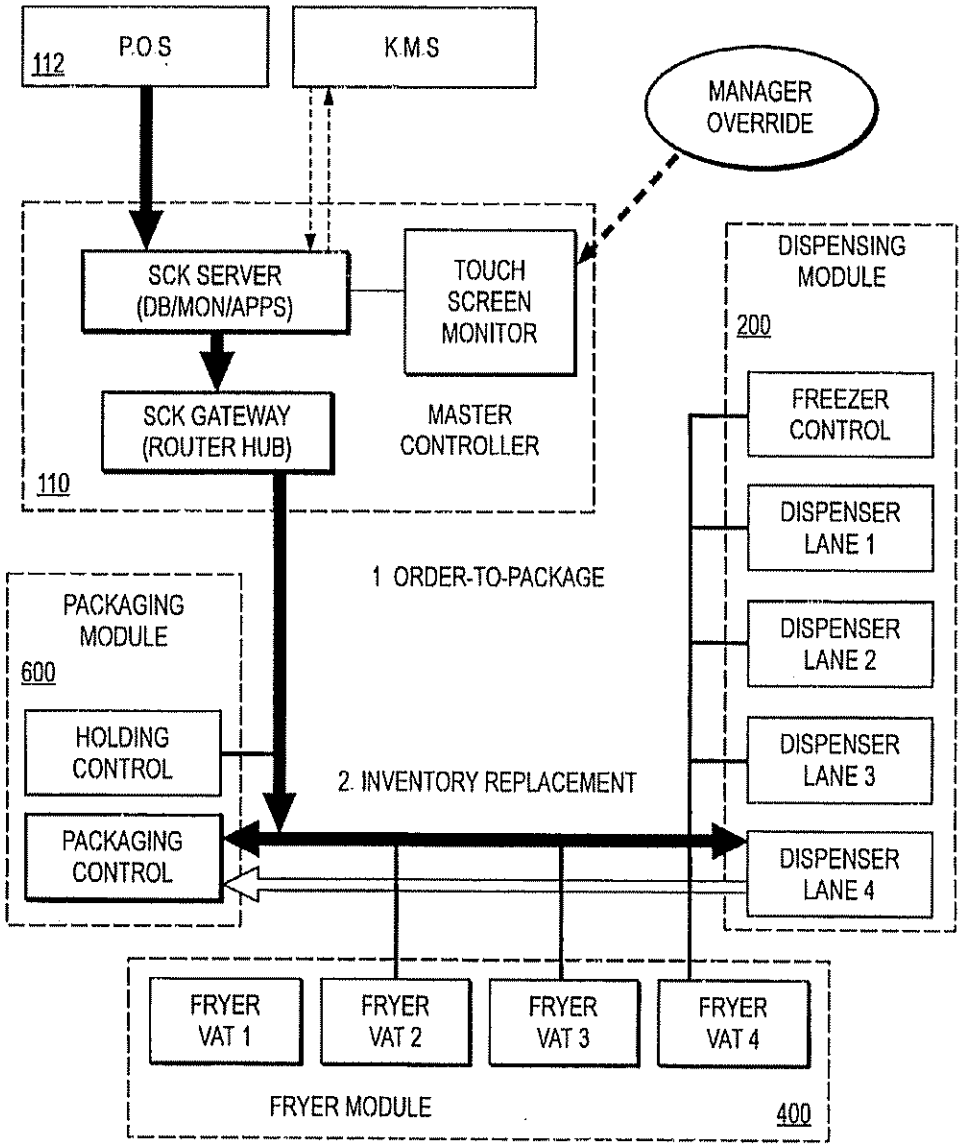

112
P.O.S
K.M.S
MANAGER OVERRIDE
SCK SERVER (DB/MON/APPS)
TOUCH SCREEN MONITOR
SCK GATEWAY (ROUTER HUB)
MASTER CONTROLLER
110
DISPENSING MODULE
200
FREEZER CONTROL
DISPENSER LANE 1
DISPENSER LANE 2
DISPENSER LANE 3
DISPENSER LANE 4
1 ORDER-TO-PACKAGE
PACKAGING MODULE
600
HOLDING CONTROL
PACKAGING CONTROL
2. INVENTORY REPLACEMENT
FRYER VAT 1
FRYER VAT 2
FRYER VAT 3
FRYER VAT 4
FRYER MODULE
400

FIG. 71

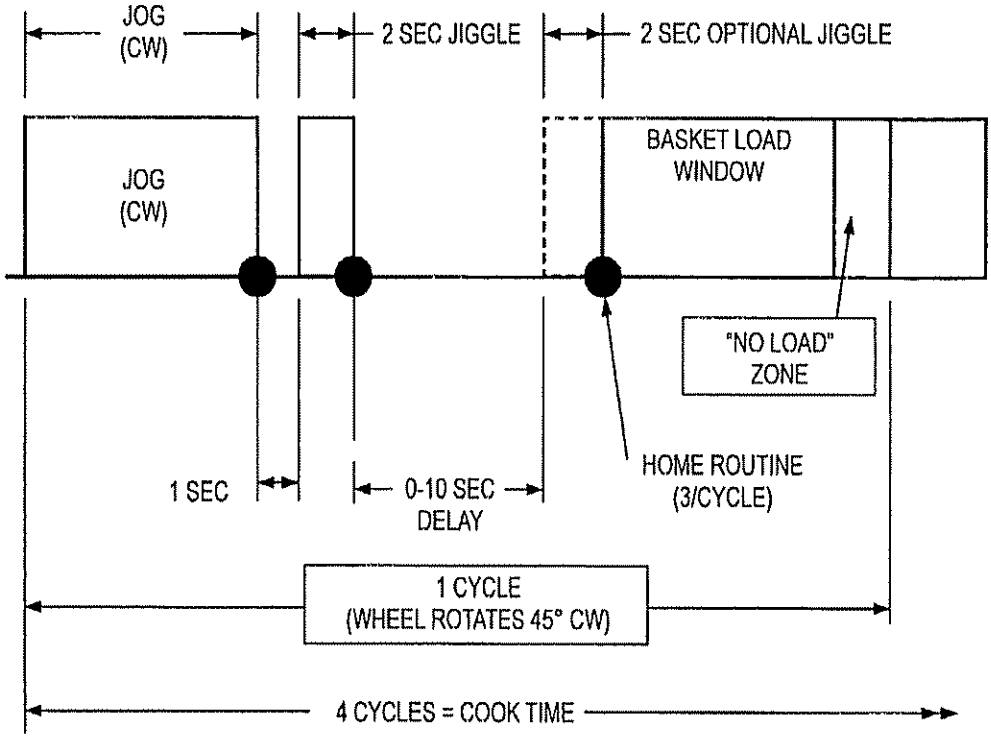

JOG
(CW)
2 SEC JIGGLE
2 SEC OPTIONAL JIGGLE
JOG
(CW)
BASKET LOAD
WINDOW
"NO LOAD"
ZONE
HOME ROUTINE
(3/CYCLE)
1 SEC
0-10 SEC
DELAY
1 CYCLE
(WHEEL ROTATES 45° CW)
4 CYCLES = COOK TIME

FIG. 72

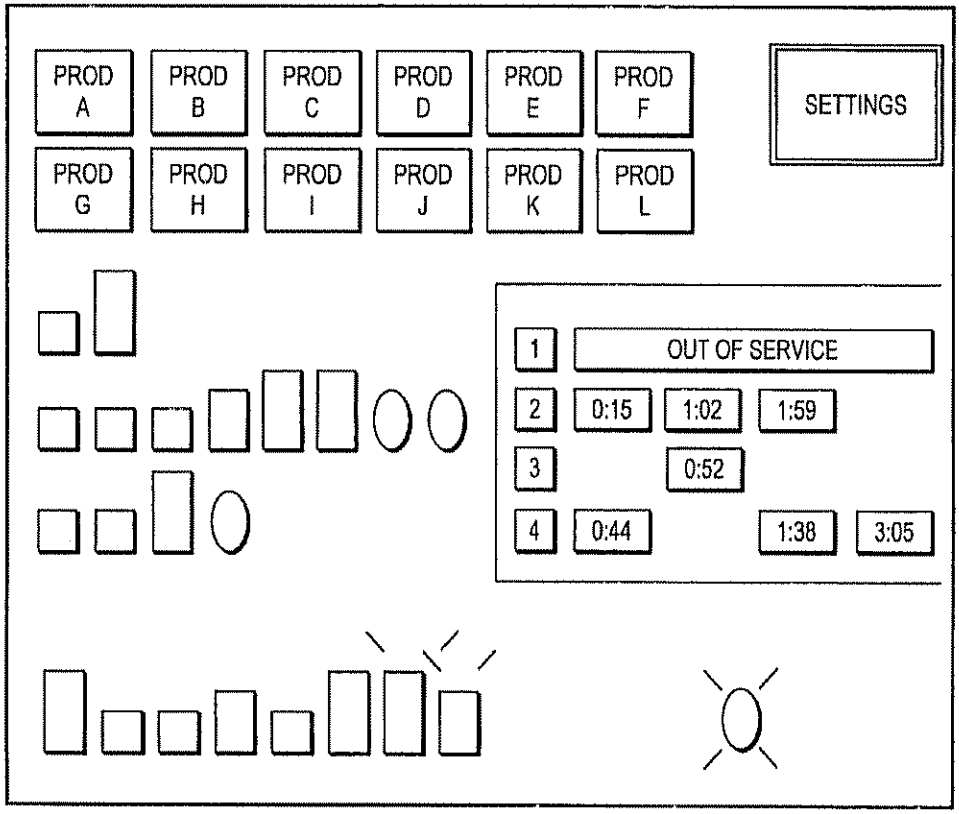

PROD A
PROD B
PROD C
PROD D
PROD E
PROD F
PROD G
PROD H
PROD I
PROD J
PROD K
PROD L
SETTINGS
1
OUT OF SERVICE
2
0:15
1:02
1:59
3
0:52
4
0:44
1:38
3:05

FIG. 73

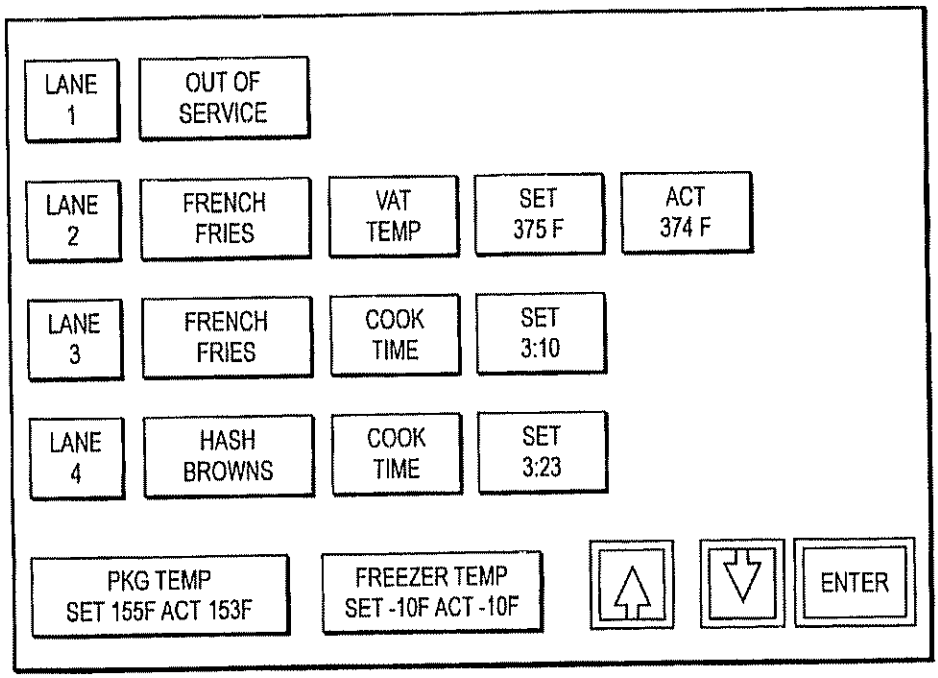

LANE 1
OUT OF SERVICE
LANE 2
FRENCH FRIES
VAT TEMP
SET 375 F
ACT 374 F
LANE 3
FRENCH FRIES
COOK TIME
SET 3:10
LANE 4
HASH BROWNS
COOK TIME
SET 3:23
PKG TEMP SET 155F ACT 153F
FREEZER TEMP SET -10F ACT -10F
ENTER

FIG. 74

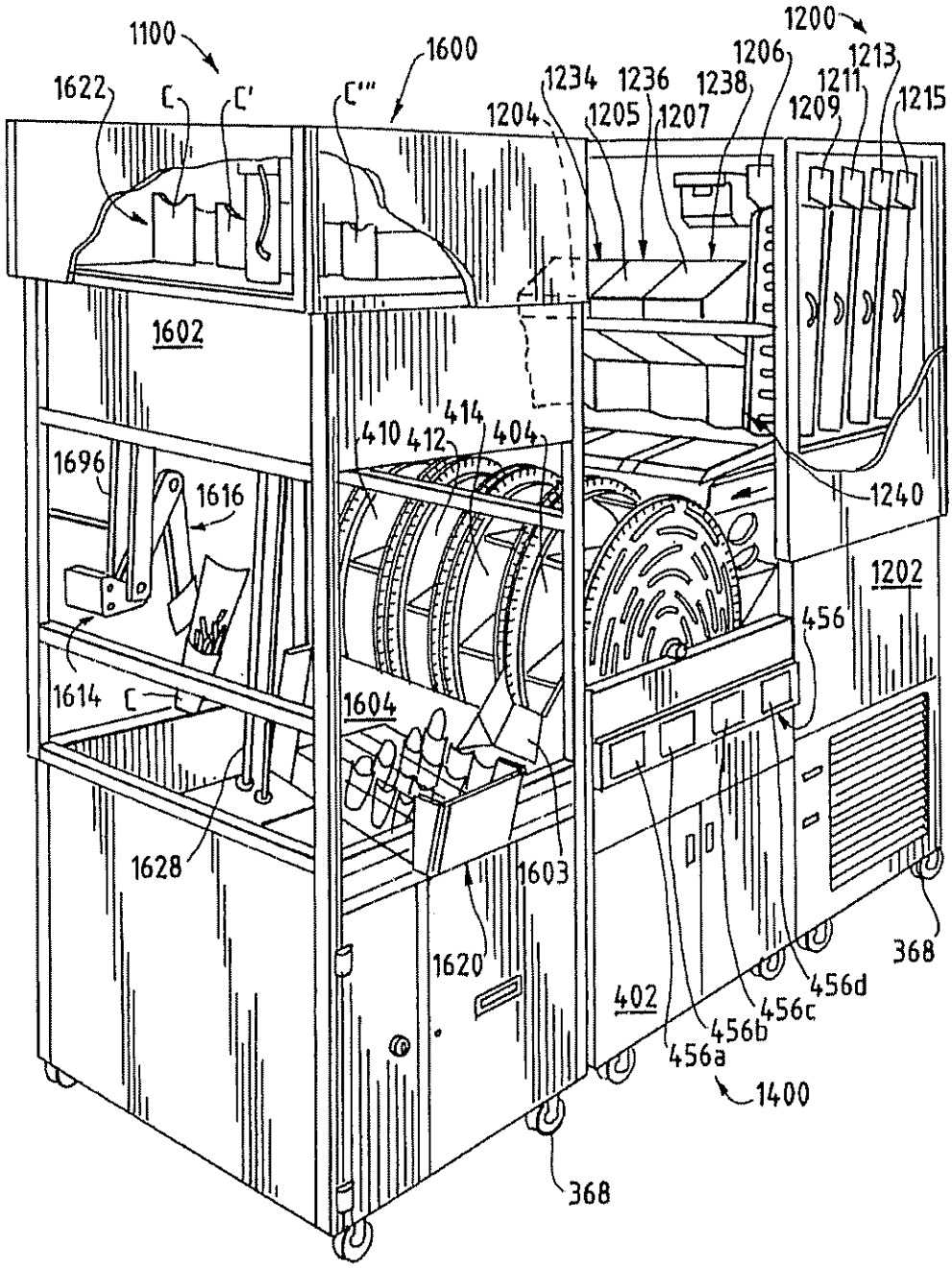

1100
1600
1200
1622
C
C'
C'''
1234
1236
1238
1206
1213
1211
1204
1205
1207
1209
1215
1602
414
410
412
404
1696
1616
1240
1202
456
1614
1604
1628
1603
1620
368
402
456d
456c
456b
456a
1400
368

FIG. 75

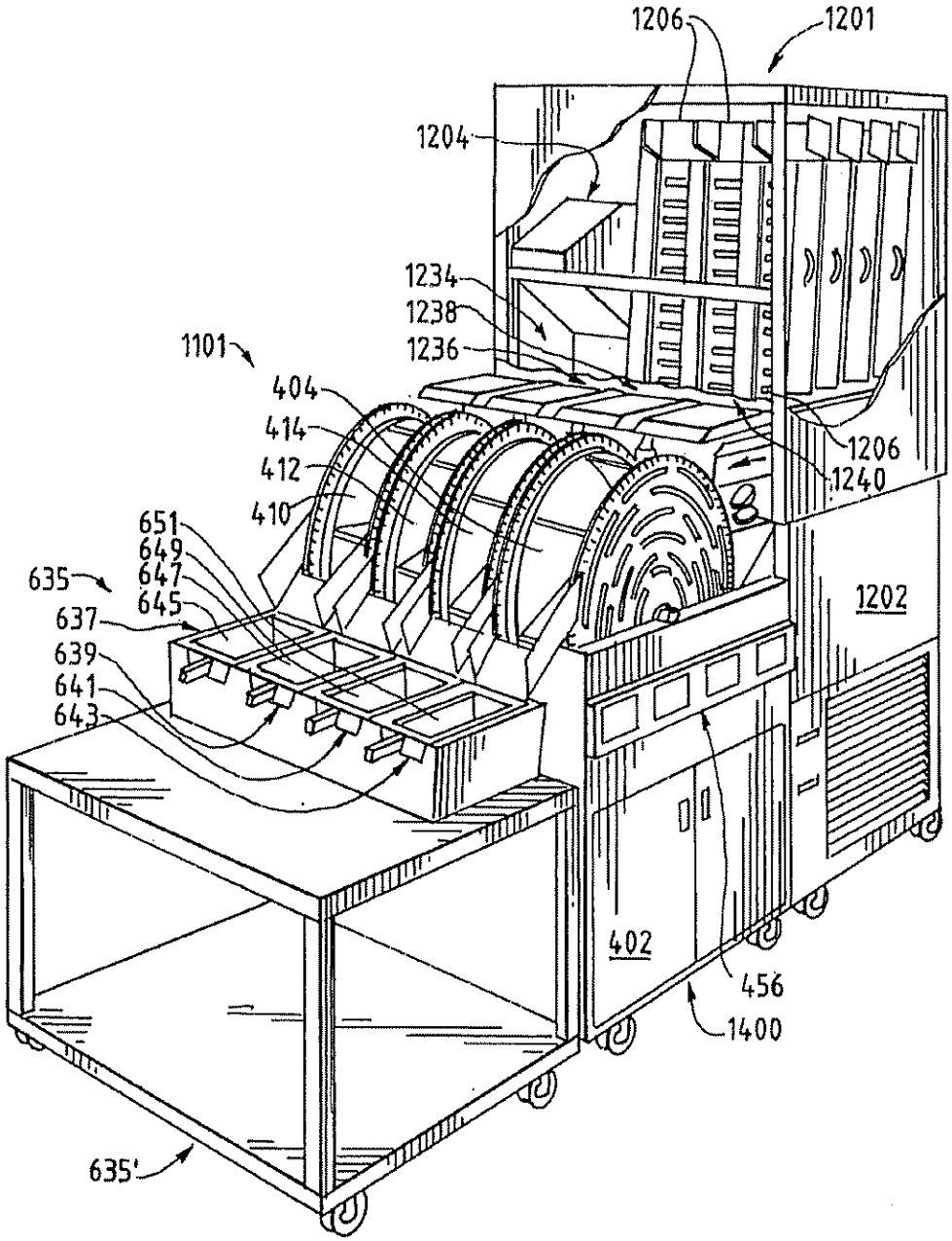

1206
1201
1204
1234
1238
1236
1101
404
414
412
410
1206
1240
651
649
647
645
635
637
639
641
643
1202
402
456
1400
635'

FIG. 76

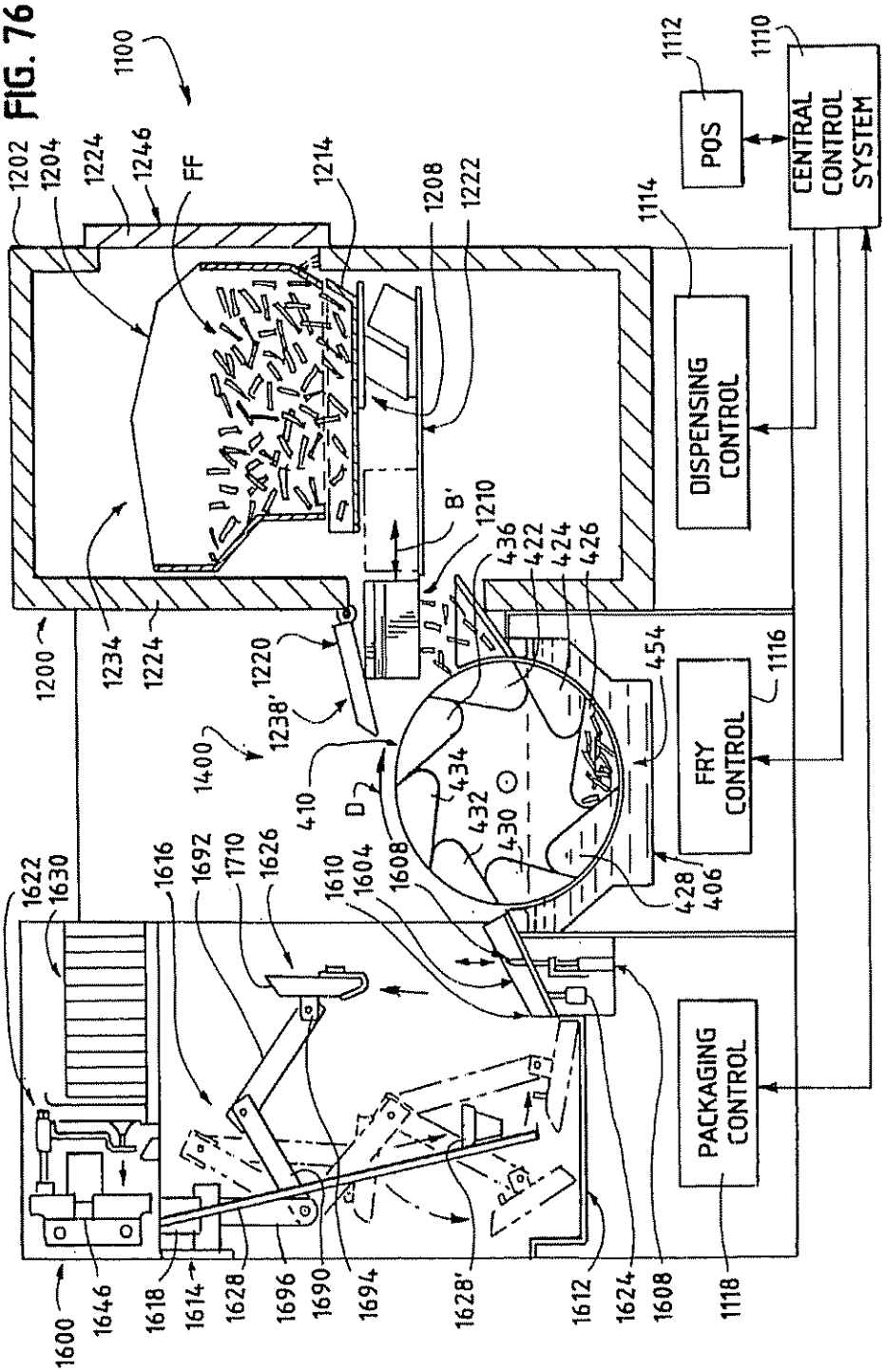

1100
1202
1204
1224
1246
FF
1214
1208
1222
1114
POS
1112
CENTRAL CONTROL SYSTEM
1110
DISPENSING CONTROL
B'
1210
436
422
424
426
1200
1234
1224
1220
1238'
1400
410
D
434
432
430
454
1116
FRY CONTROL
428
406
1622
1630
1616
1692
1710
1626
1610
1604
1608
PACKAGING CONTROL
1600
1646
1618
1614
1628
1696
1690
1694
1628'
1612
1624
1608
1118

FIG. 77

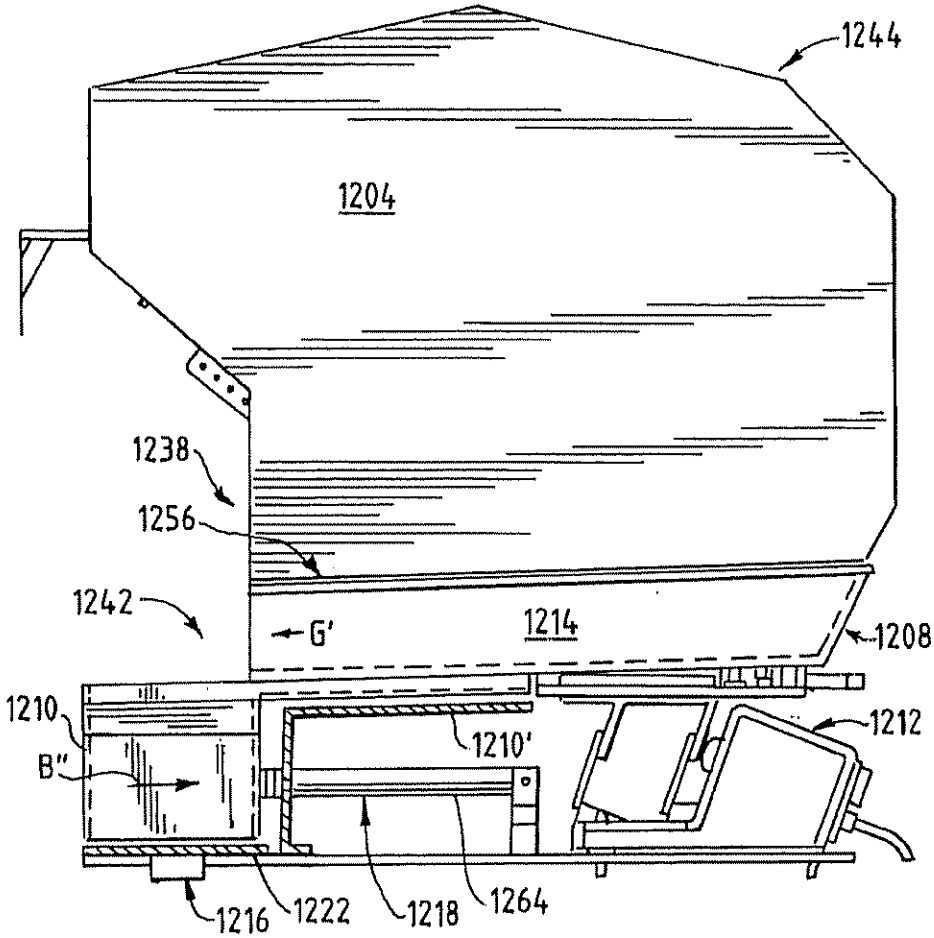

1244
1204
1238
1256
1242
G'
1214
1208
1210
B"
1210'
1212
1216
1222
1218
1264

FIG. 77A

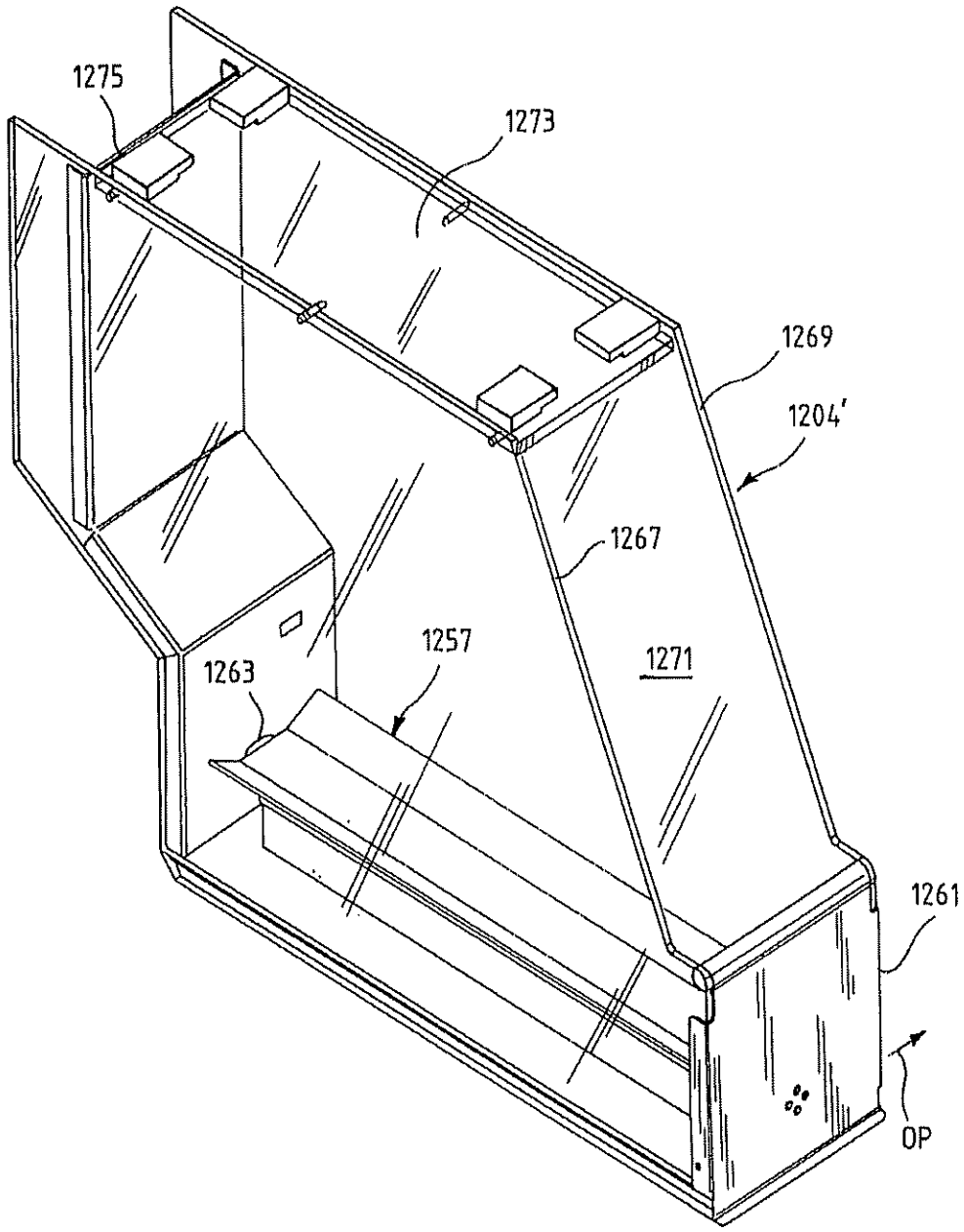


FIG. 77B

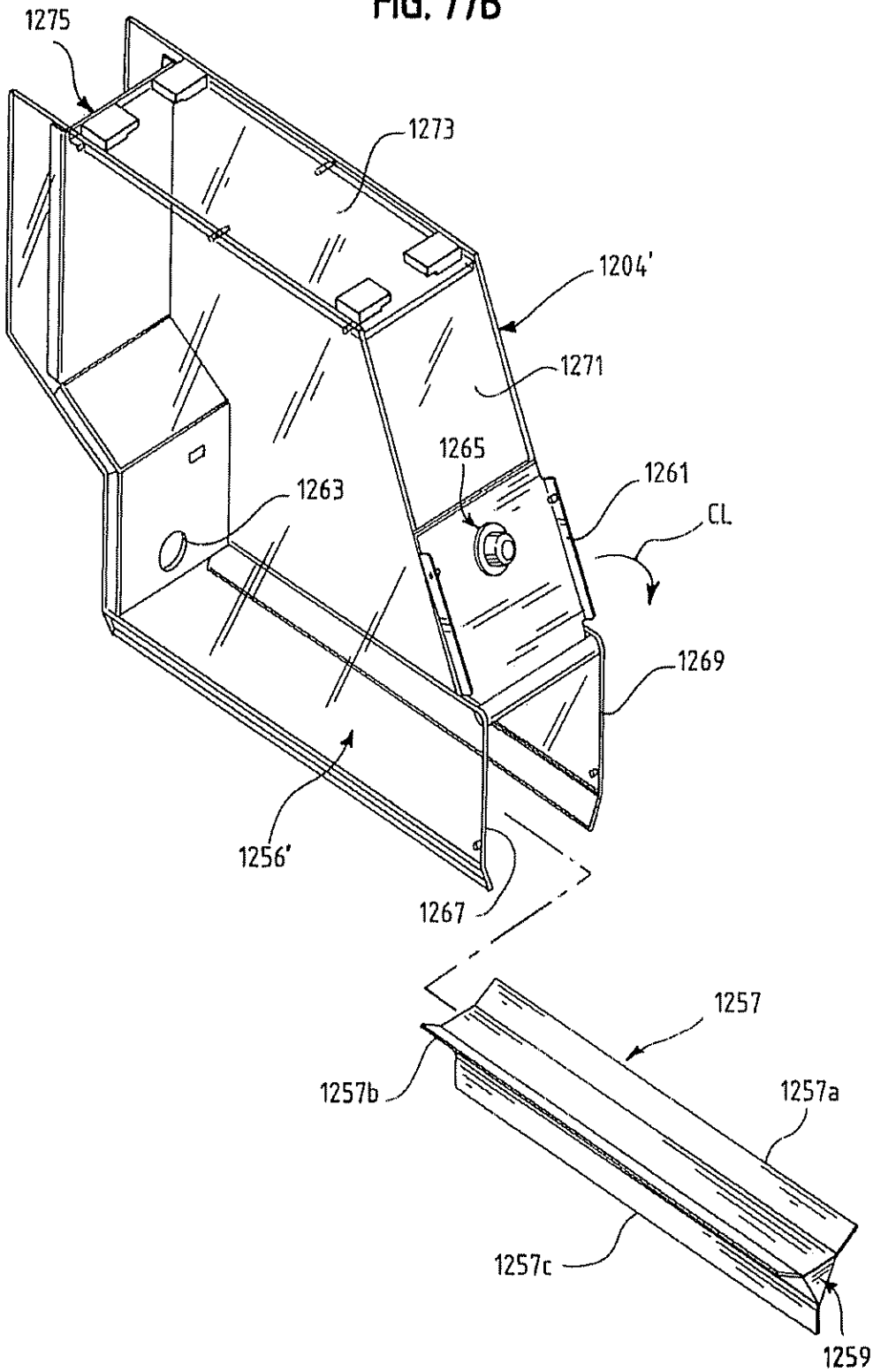

1275
1273
1204'
1271
1265
1261
1263
CL
1269
1256'
1267
1257
1257b
1257a
1257c
1259

FIG. 77C

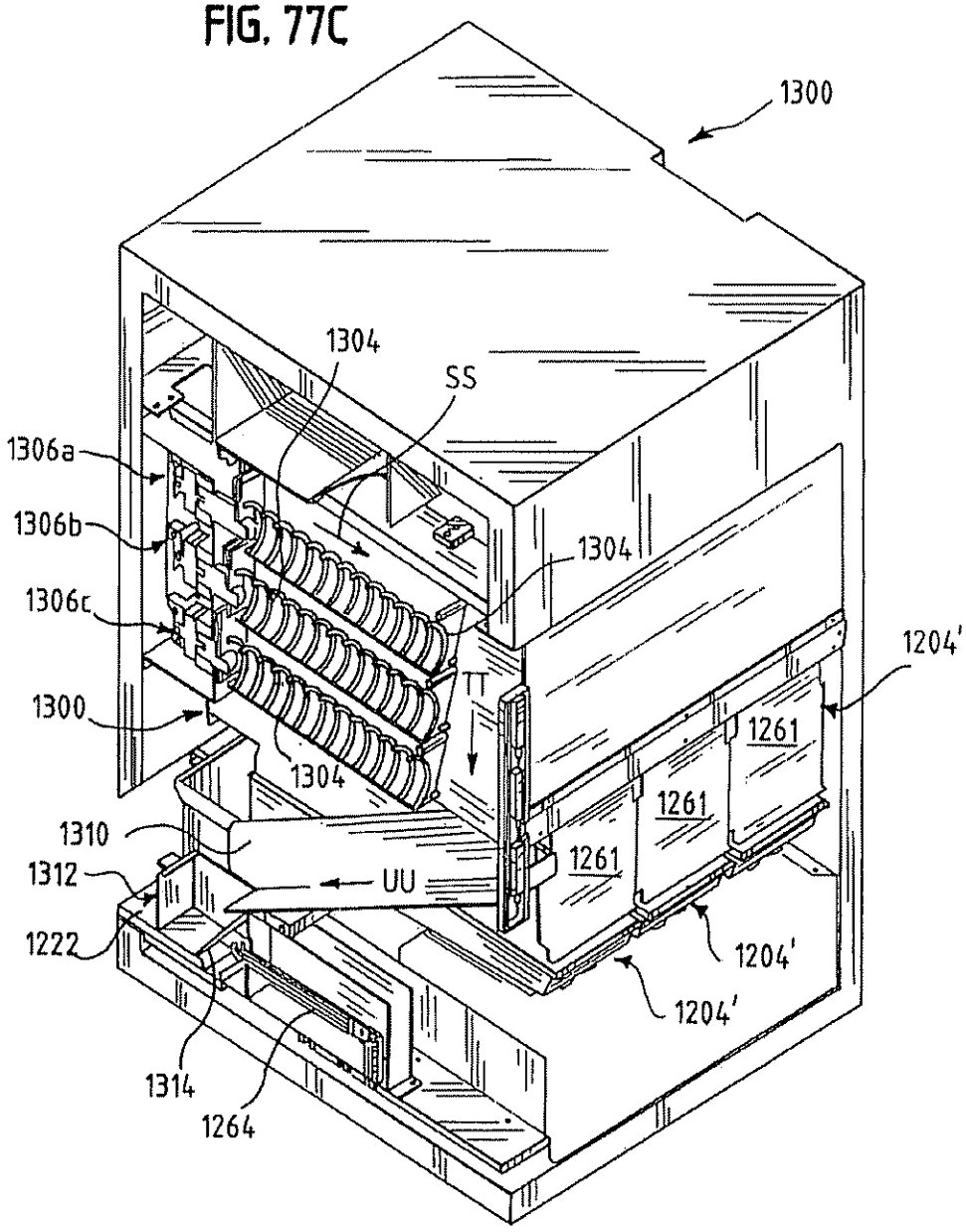

1300
1304
SS
1306a
1306b
1306c
1304
1204'
1300
TT
1261
1304
1261
1310
1261
1312
UU
1222
1204'
1204'
1314
1264

FIG. 77D

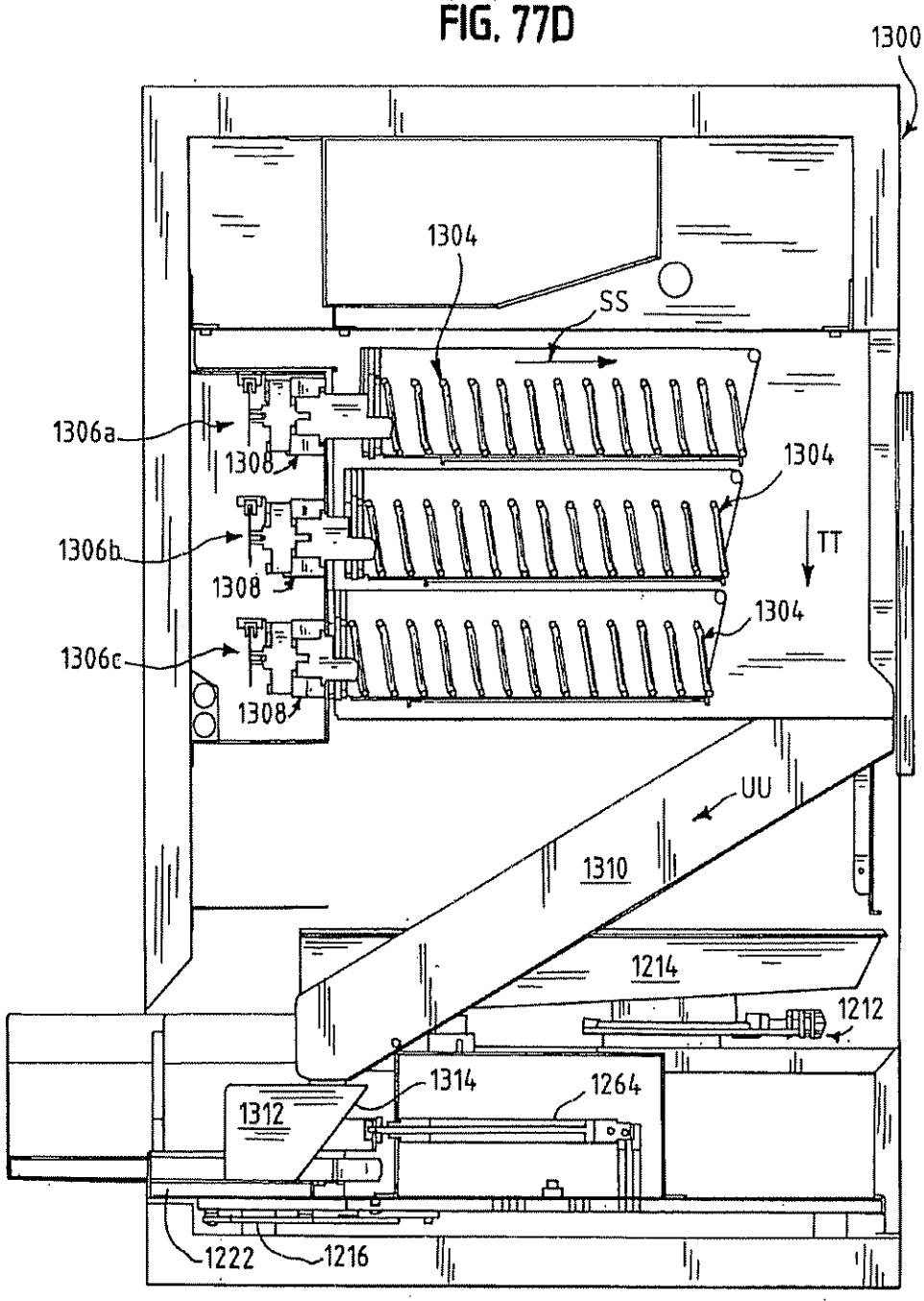

1300
1304
SS
1306a
1308
1304
1306b
1308
TT
1304
1306c
1308
UU
1310
1214
1212
1314
1264
1312
1222
1216

FIG. 78

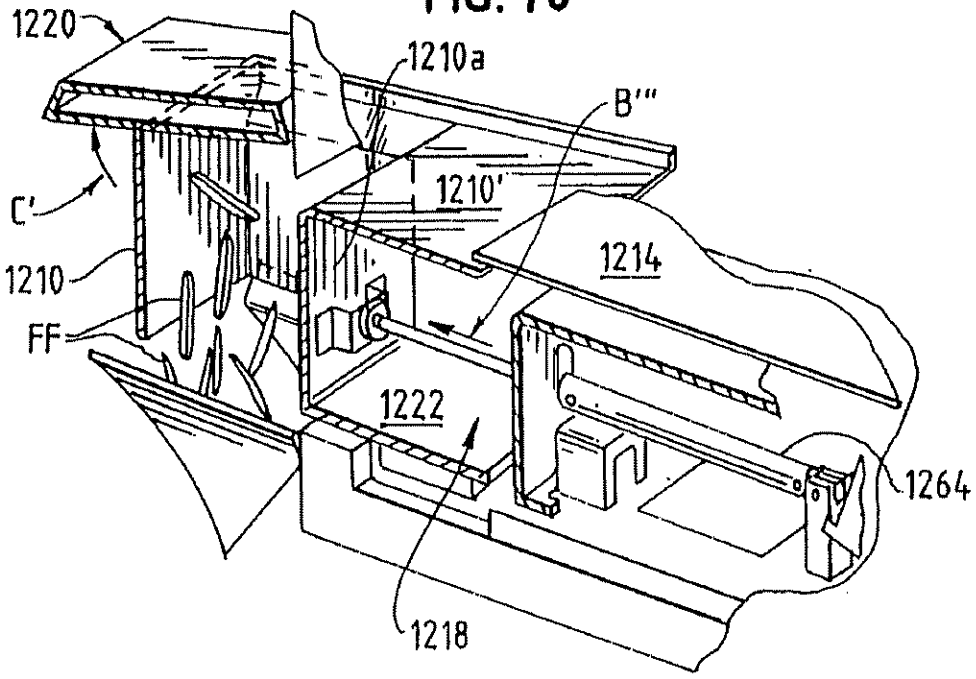


FIG. 79

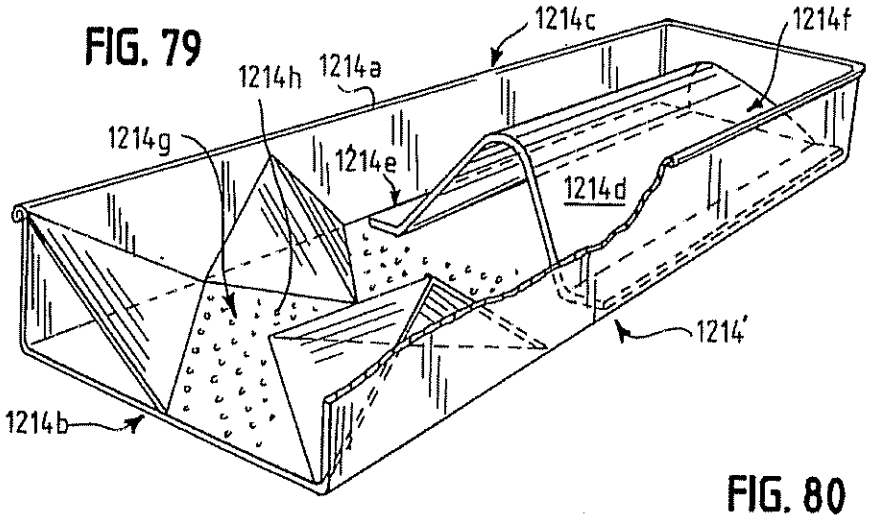


FIG. 80

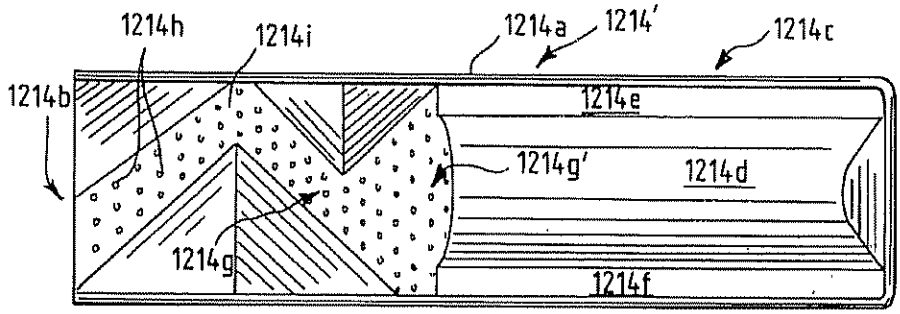


FIG. 81

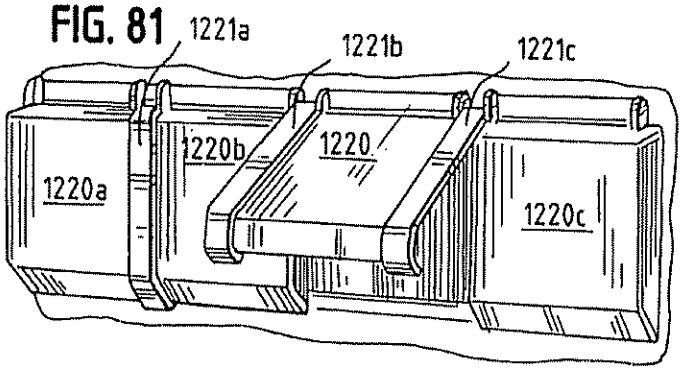


FIG. 82

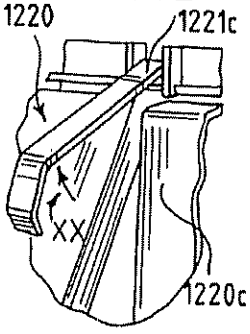


FIG. 83

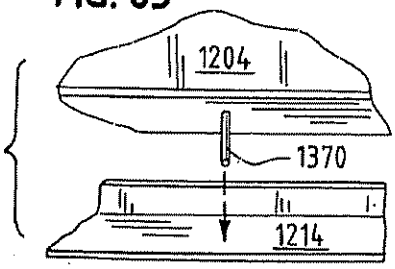


FIG. 84

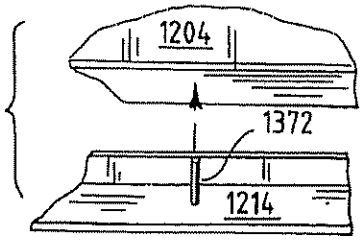


FIG. 85

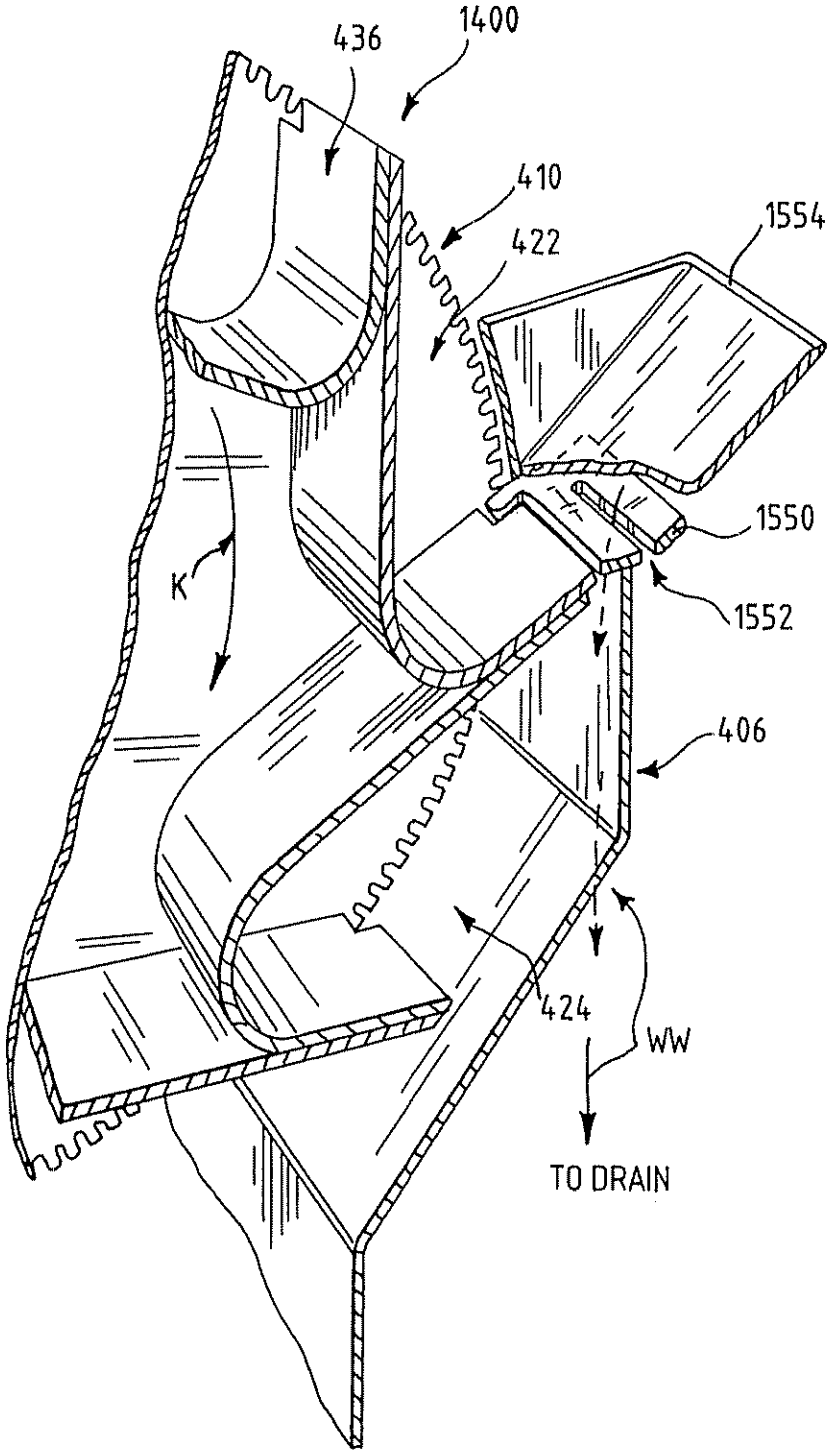


FIG. 86

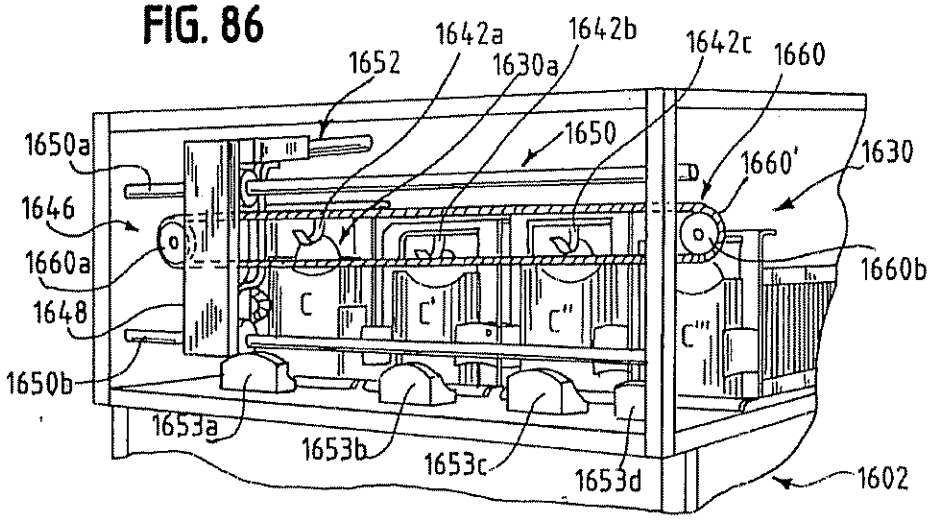

1652
1642a
1630a
1642b
1642c
1660
1650
1650a
1660'
1630
1646
1660a
1660b
1648
C
C'
C''
C'''
1650b
1653a
1653b
1653c
1653d
1602

FIG. 87

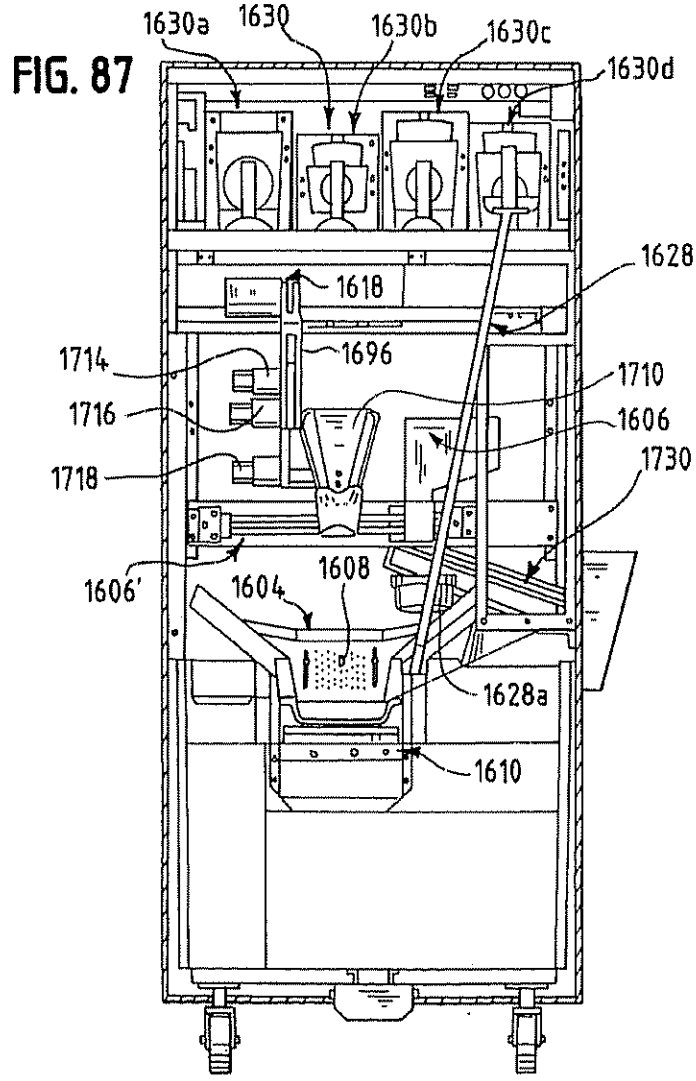
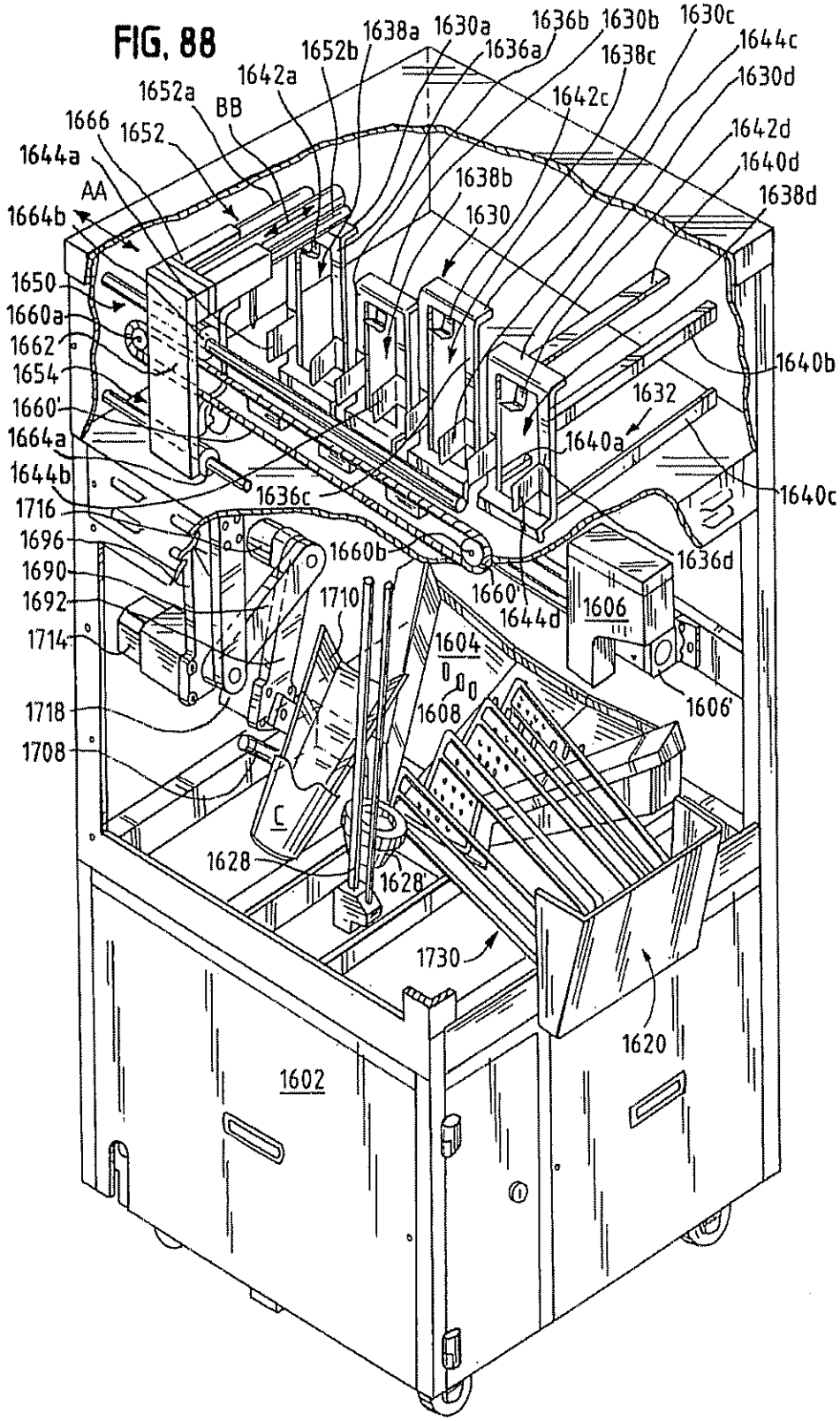

1630a
1630
1630b
1630c
1630d
1628
1618
1714
1696
1710
1716
1606
1718
1730
1606'
1608
1604
1628a
1610

FIG. 88


1652b
1638a
1630a
1636b
1630b
1630c
1644c
1642a
1652a
BB
1636a
1638c
1630d
1642c
1666
1652
1642d
1644a
1640d
AA
1638b
1638d
1664b
1630
1650
1660a
1662
1640b
1654
1632
1660'
1640a
1664a
1644b
1636c
1640c
1716
1696
1660b
1636d
1690
1710
1660'
1692
1644d
1606
1714
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1606'
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FIG. 89A

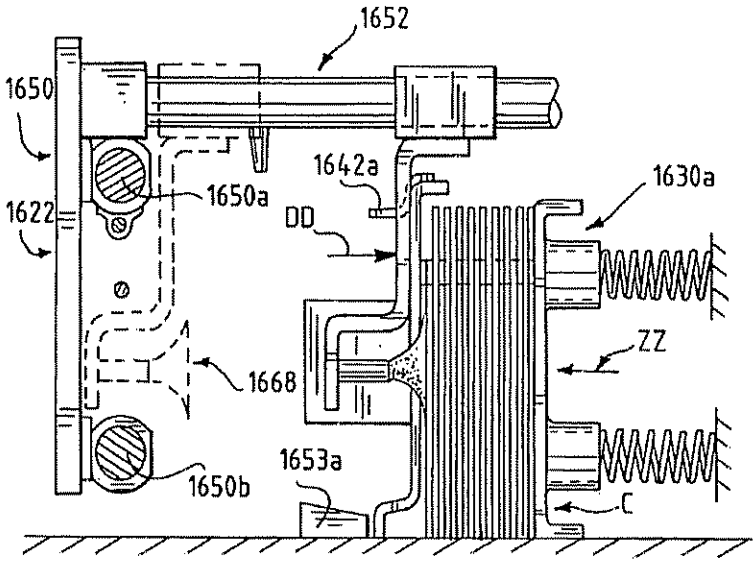


FIG. 89B

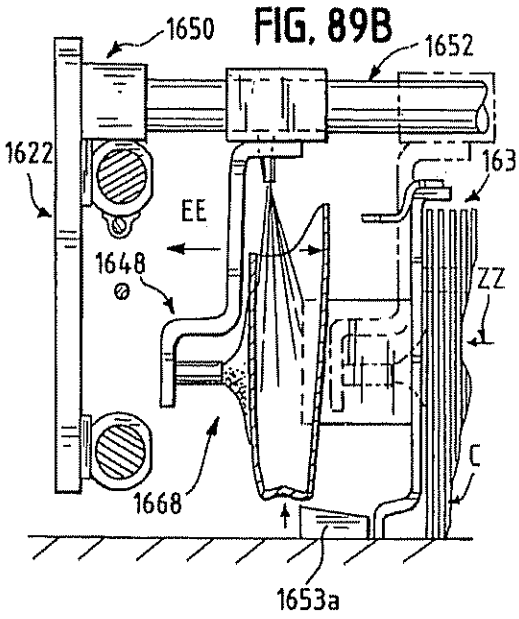


FIG. 89C

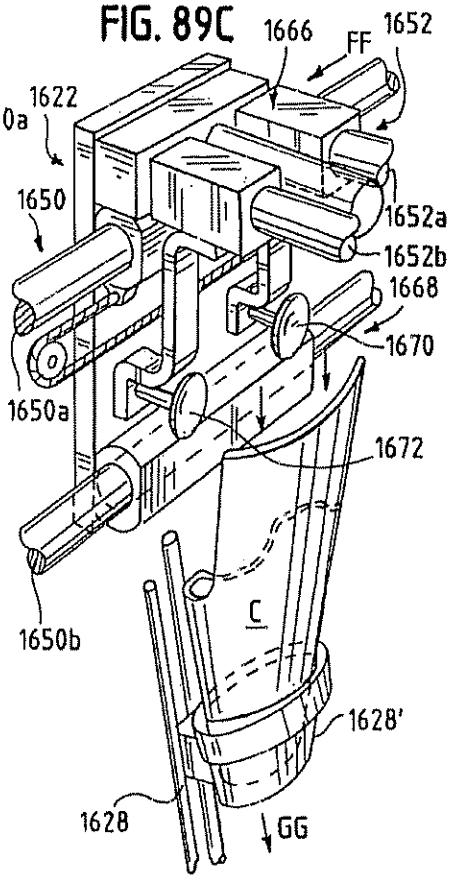


FIG. 89D

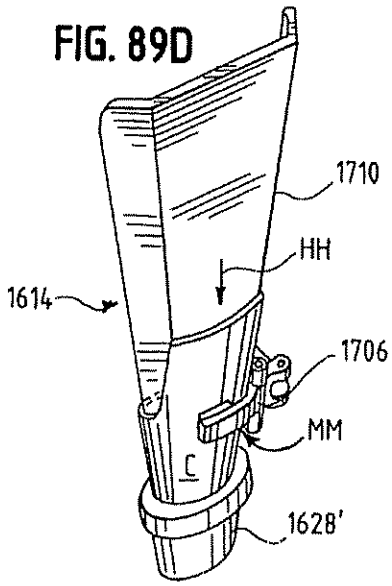
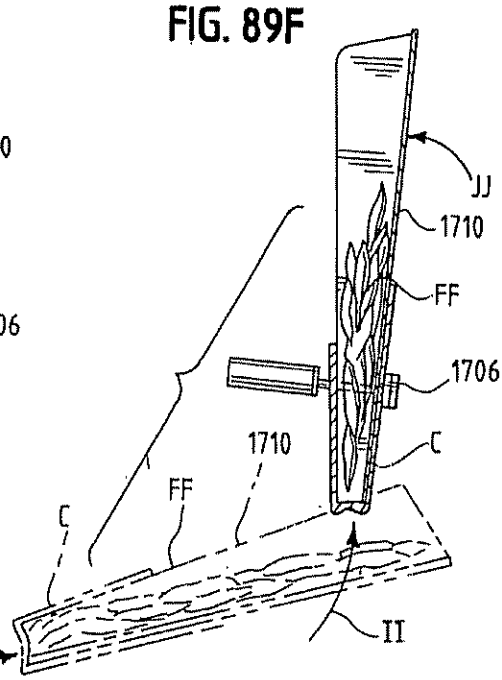


FIG. 89F



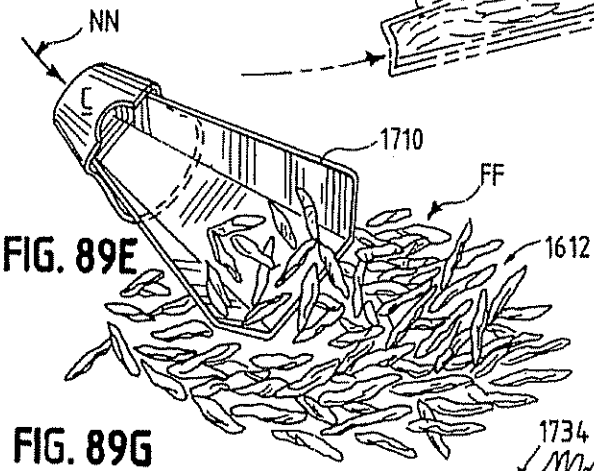


FIG. 89E

FIG. 89I

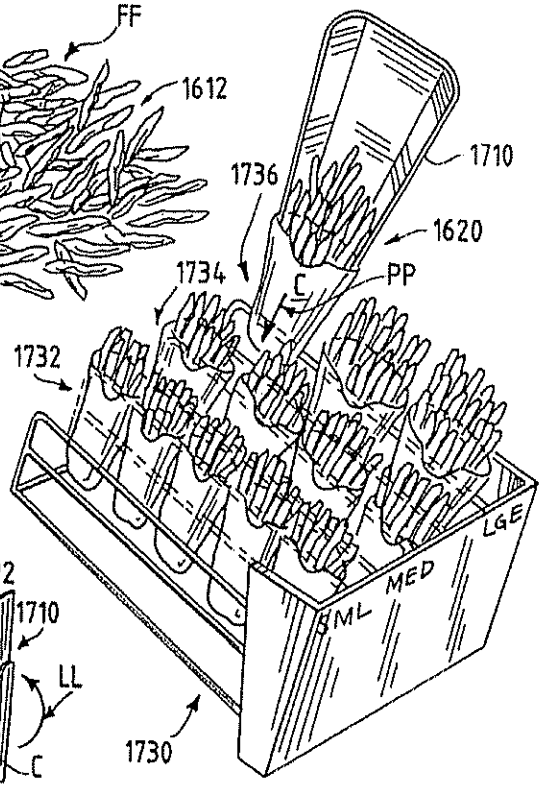
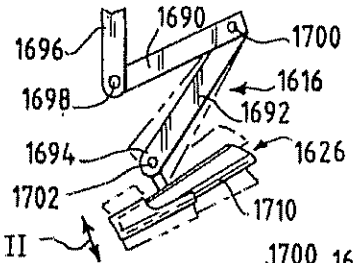


FIG. 89G



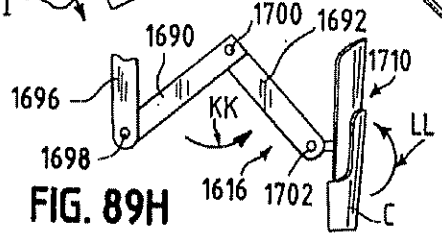
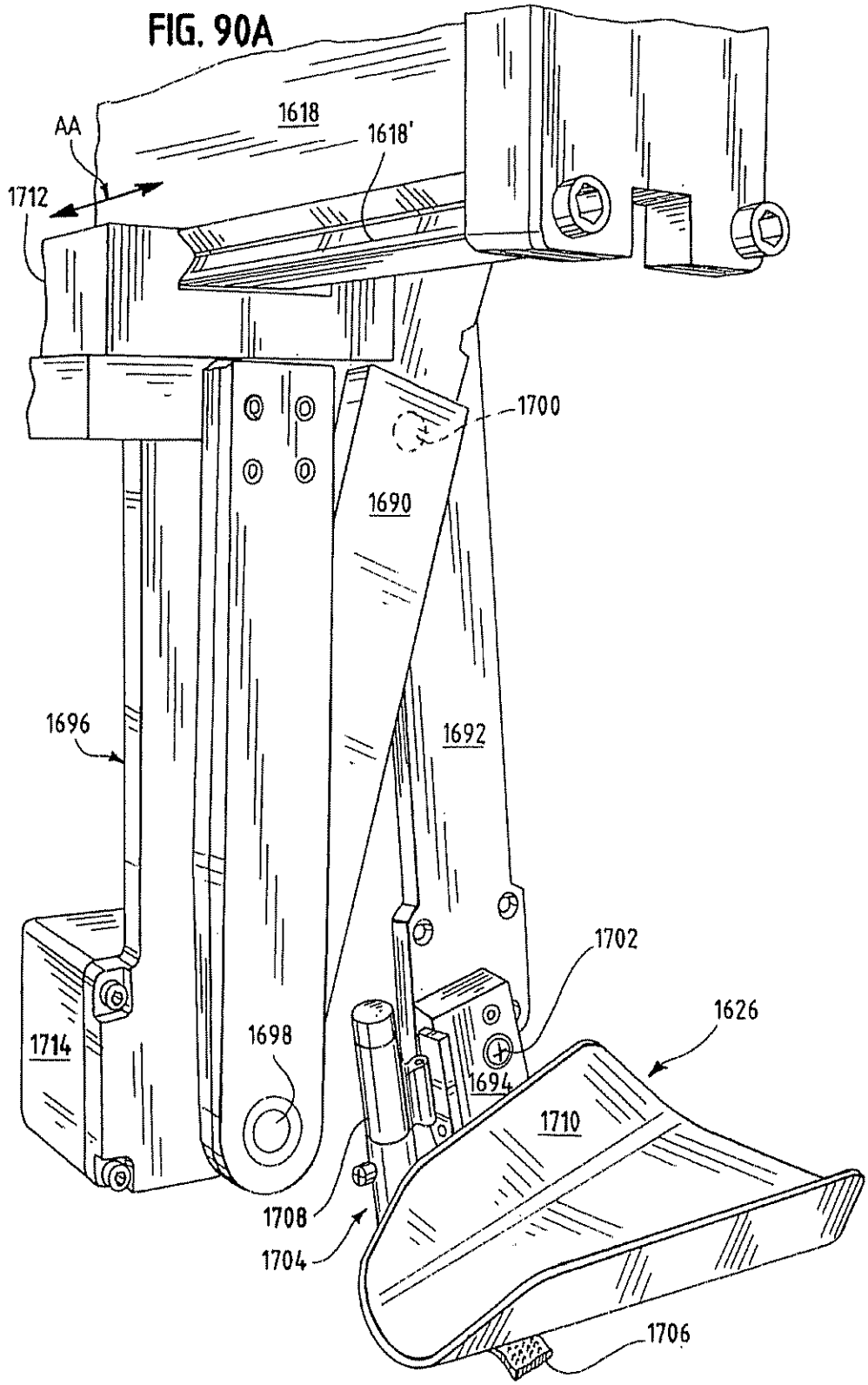


FIG. 89H

FIG. 90A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1618'
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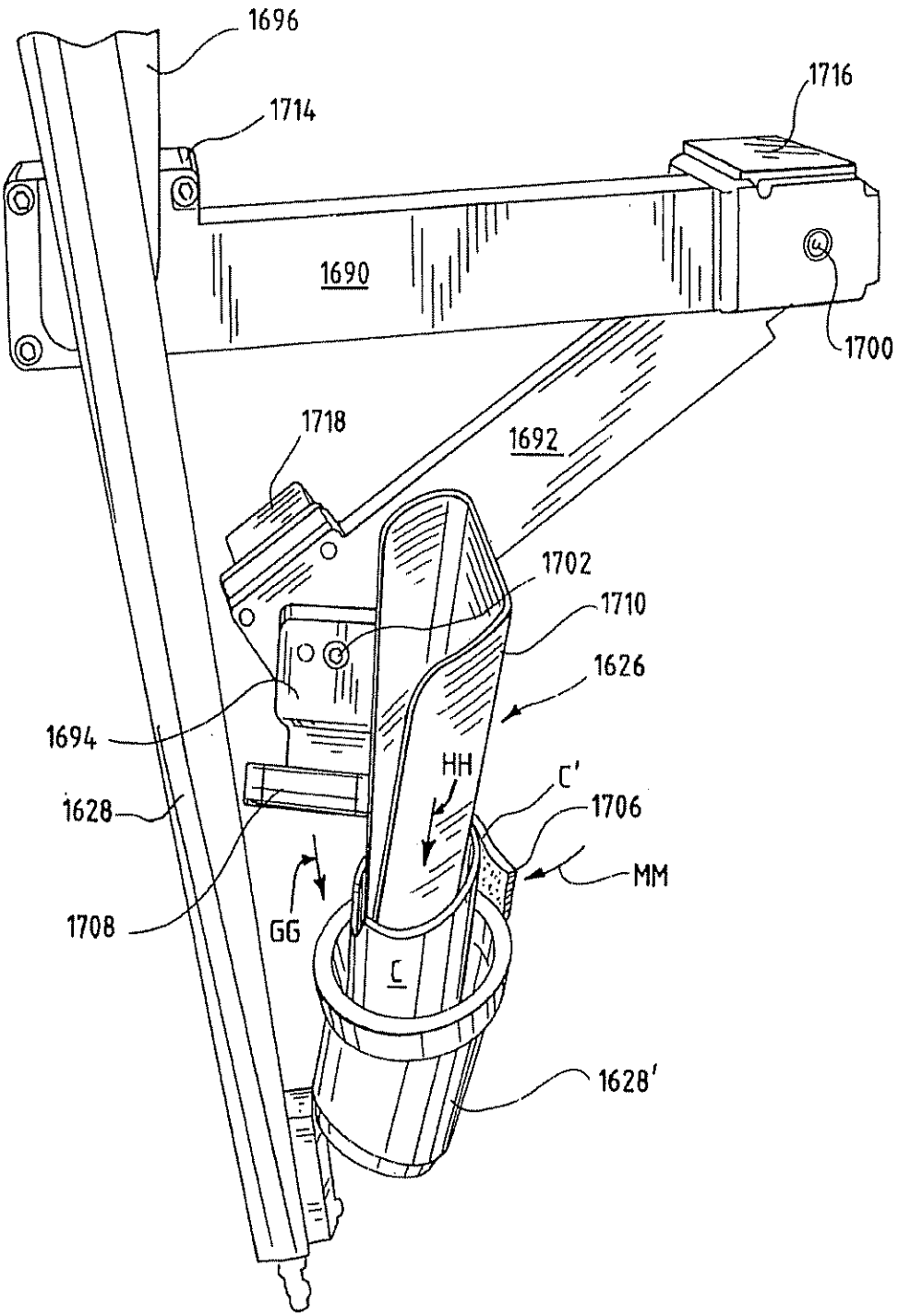
FIG. 90B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MM
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GG
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1628'

FIG. 90C

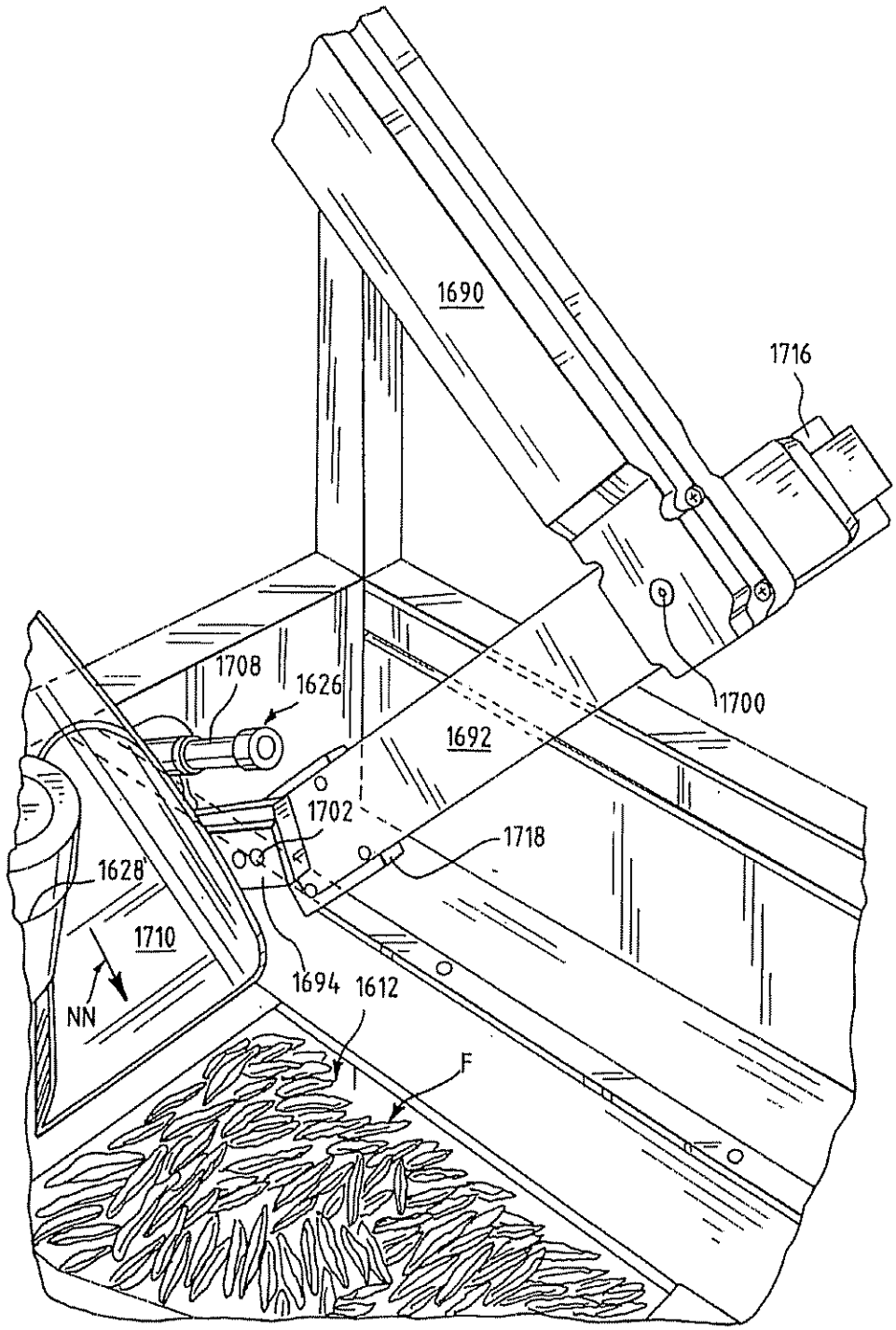
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FIG. 90D

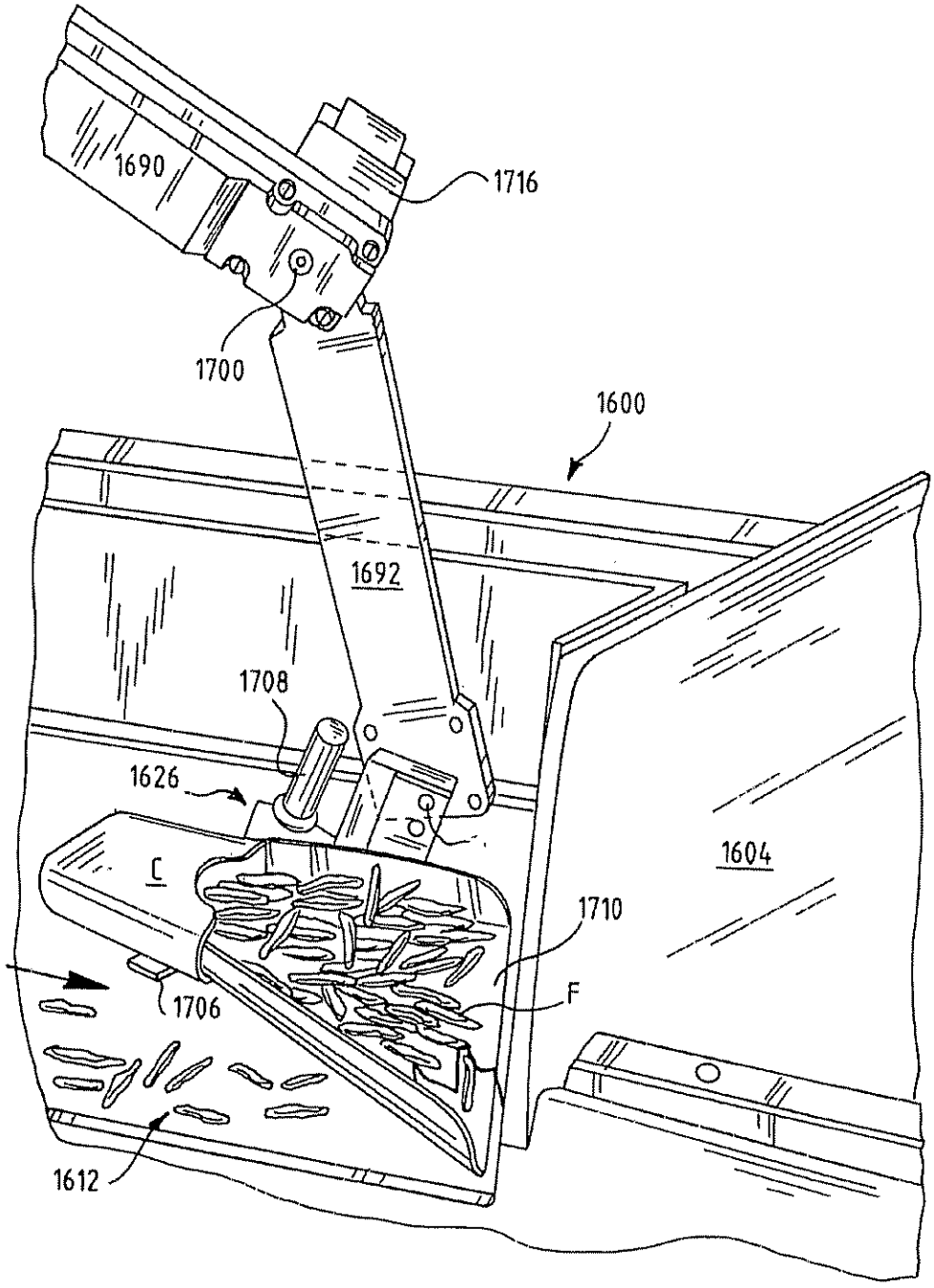

FIG. 90E

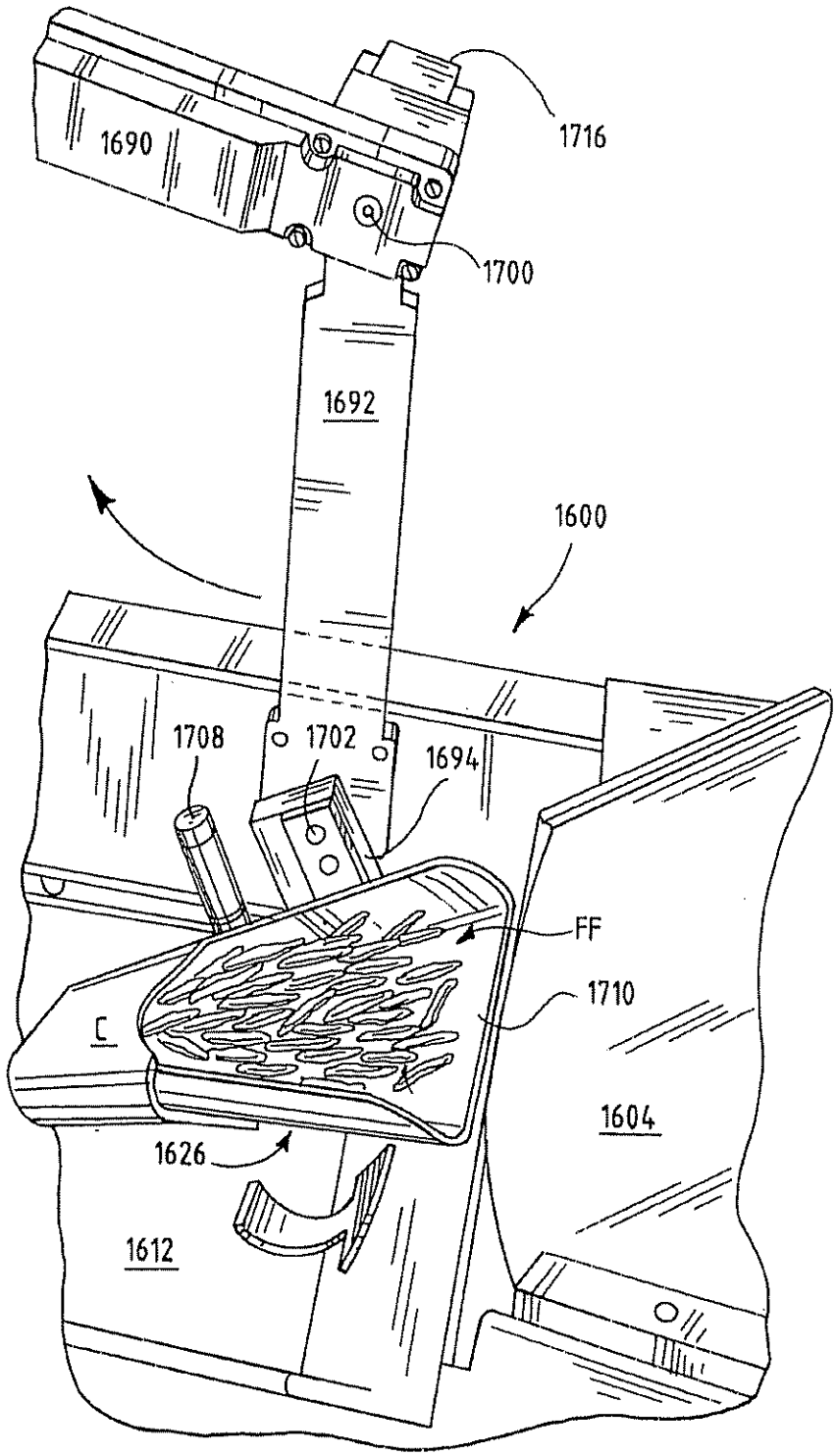
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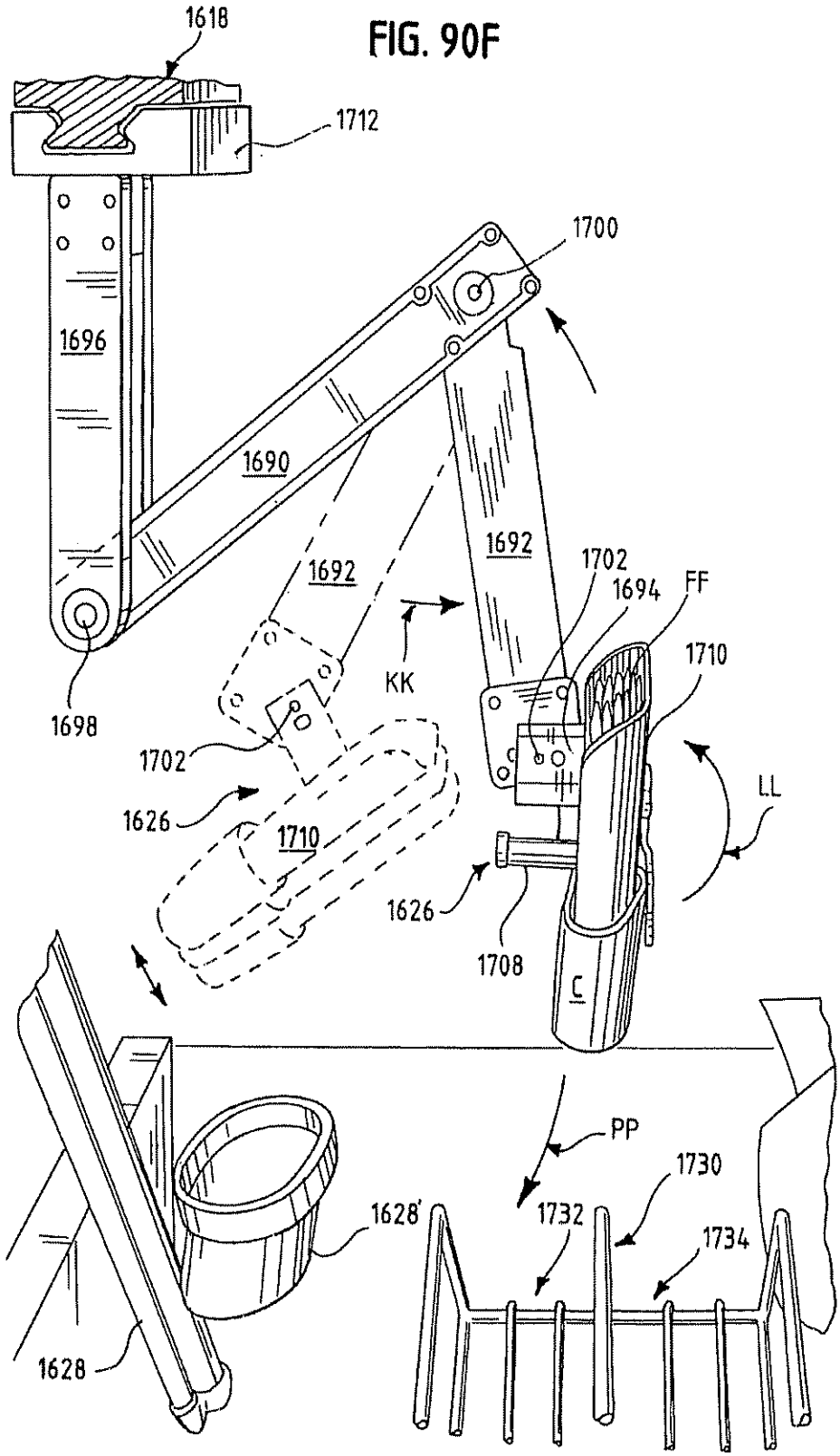
FIG. 90F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FF
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PP
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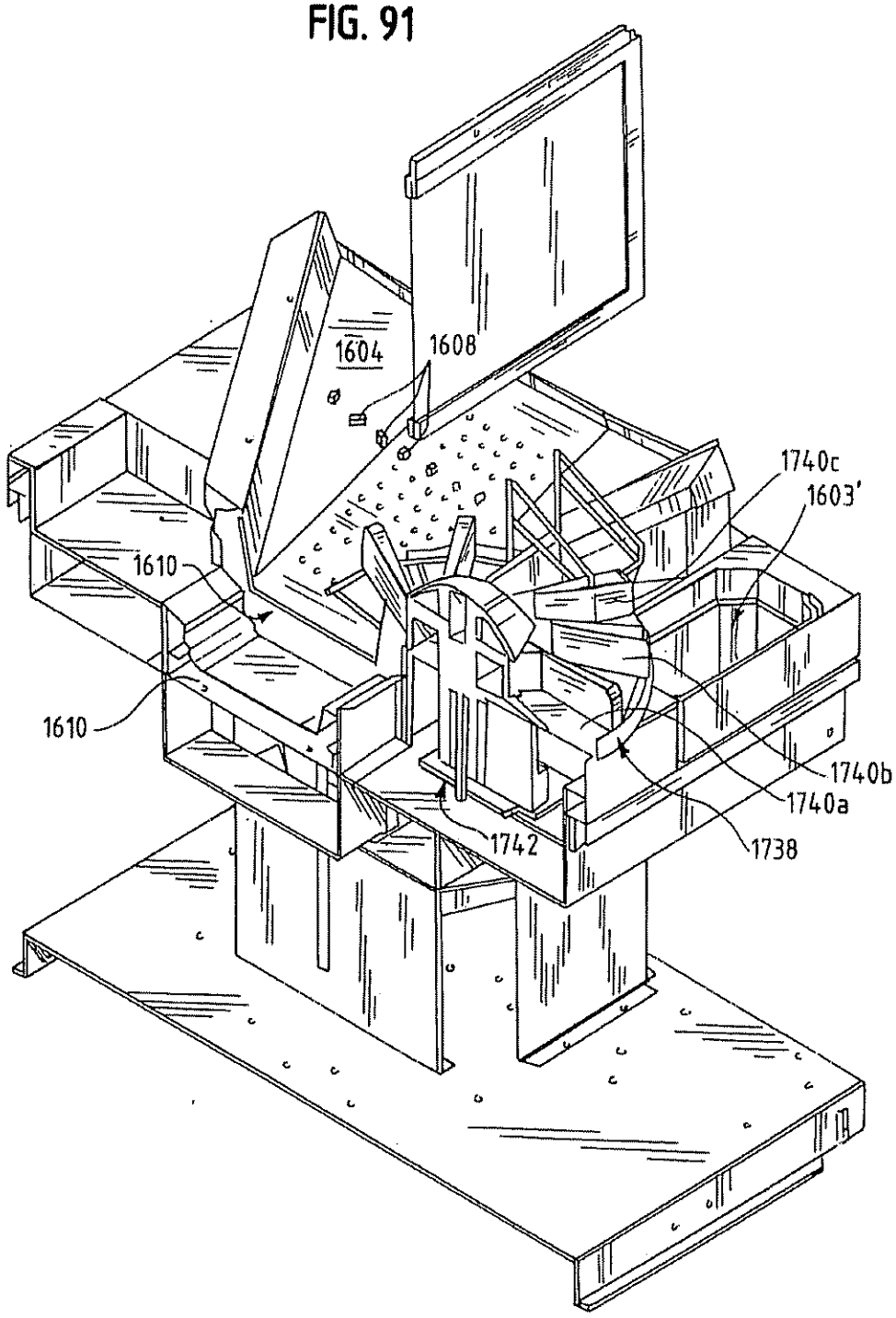
FIG. 91



AUTOMATED FOOD FRYING DEVICE AND METHOD

FIELD OF THE INVENTION

[0001] The invention relates to automated food processing. More particularly, the invention relates to automated food dispensing, frying and packaging into individual portion-sized containers such as at a quick-service type restaurant.

BACKGROUND OF THE INVENTION

[0002] In restaurants, especially quick service (fast food) restaurants, fast, consistent, efficient and safe food preparation is essential for a successful operation. The quality of the prepared food depends in large part on the consistency of food preparation. The food must be cooked under correct conditions for the proper time.

[0003] Consistency in food preparation can vary as a result of many factors. For example, people engaged in food preparation often must perform multiple tasks at frequencies that vary with time because of constantly varying customer demand throughout the day. For example, lunchtime and dinnertime may be extremely busy while other periods may be relatively slow. The product mix can vary from hour to hour and day to day. As a result, the consistency and quality of food may vary. Difficulties in proper scheduling of food production during peak and non-peak periods can cause customer delays and/or stale, wasted or unusable food.

[0004] Food preparation can be labor intensive, and thus, the labor cost can be a large portion of the total cost of the prepared food. An additional problem is that in sparsely populated and other areas where quick service restaurants are located, such as along interstate highways, for example, recruiting sufficient numbers of suitable employees is difficult.

[0005] Quick service restaurants must be able to effectively meet a variable customer demand that is time dependent and not subject to precise prediction. As a result, stores relying totally on human operators will at times be over-staffed and at other times be under-staffed. Also, problems and potential problems can exist in restaurants where people directly prepare food. Health and safety concerns can also be present where food is prepared directly by people. By reducing or minimizing human contact with food and food cooking equipment, health and safety concerns can also be reduced or minimized. For example, in the frying of foods, some type of hot fluid, such as cooking oil or shortening must be utilized. The cooking temperatures required can present a concern for health and safety.

[0006] Although quick service restaurants have existed for many years and now number in the tens of thousands, such establishments utilize manual labor to prepare and process food. While there have been various improvements in commercial equipment used for cooking food in quick service restaurants, such restaurants are believed to be substantially all manually operated and relatively labor intensive.

[0007] Accordingly, a need exists for an automated, commercially suitable food dispensing, cooking and packaging device, system and method for fried foods that can be operated with a minimum of human intervention, control and maintenance. More particularly, a need exists for an automated device, system and method that is capable of, without human labor, frying various food products in desired quantities, such as French fries, seasoning the cooked food and packaging the cooked food in individual portion-sized containers.

SUMMARY OF THE INVENTION

[0008] In accordance with the present invention, an automated food processing system and method is provided. The automated food processing system and method in accordance with the invention allows food to be dispensed, fried and packaged in a suitable container or alternatively dispensed to a food holding area for subsequent processing by a human operator.

[0009] In accordance with one aspect of the present invention, an automated module system for dispensing, frying and packaging food into individual portion-sized containers is provided. In one embodiment, any suitable automated dispensing device can be used. In another embodiment, the system includes an automated dispensing module capable of dispensing a desired quantity of food to be fried, an automated fry module adjacent the dispensing module to receive and fry the quantity of food dispensed from the dispensing module and to produce and dispense a quantity of fried food and an automated packaging module adjacent the fry module to receive and package the fried food from the fry module into an individual portion-sized container.

[0010] Advantageously, in one embodiment, the three modules are independent from each other and can be operated independently. Plus, in one embodiment, any one of the modules can be deactivated and a human operator can manually perform the function of the deactivated module with manually operated equipment.

[0011] In accordance with another aspect of the invention, optionally an automated seasoning device is present to apply seasoning to the food.

[0012] Typically, the automated dispensing module in accordance with the invention in one embodiment is capable of dispensing one or more of uncooked or unheated French fries, chicken nuggets, hash browns, chicken patties and fish filets or similar types of food items to be cooked and/or heated.

[0013] In accordance with another aspect of the invention, the automated dispensing module includes a freezer, a storage container located in the freezer for containing food to be dispensed, structure for dispensing a predetermined quantity of food from the storage container into a secondary or dump container, with the structure for dispensing and the secondary or dump container being located in the freezer, and structure for dispensing the quantity of food from the secondary or dump container to a location outside of the freezer.

[0014] In accordance with another aspect of the present invention, the fry module of the automated modular system includes a fry vat for containing and heating cooking oil, at least one circular fry wheel having at least a generally circular perimeter in a plurality of compartments, each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel, which radial axis is disposed above the normal operating level of the frying oil or the

cooking oil in the fry vat A drive mechanism is provided for rotating the fry wheel In one aspect of the invention, any suitable type of automated fry device can be utilized

[0015] In accordance with another aspect of the present invention, a control system is provided for causing the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation (such as about 2-10°, for example) to simulate shaking of a fry basket. Such control can be accomplished electronically by devices known to those skilled in the art

[0016] In another embodiment, food is delivered from the fry module to a cooked food holding device, which can comprise a heated holding bin or bins

[0017] In accordance with still another aspect of the present invention, the automated packaging module includes a rotatable food dispensing member having an inlet location to receive a quantity of cooked food at a discharge location to discharge cooked food, the packaging module also including a food dispensing chute position to receive cooked food from the discharge location of the rotatable food dispenser, the food dispensing chute having a discharge location

[0018] In accordance with another embodiment of the invention, the automated modular system further includes a carton holding device for holding the individual portion-sized carton or container in position to receive food from the discharge location of the dispensing chute The packaging module may further include a rotatable food collecting member disposed to collect food from the discharge location of a dispensing chute that is not deposited into the individual portion-sized food container The so collected food may be subsequently deposited into the food dispensing chute for delivery to a container or alternatively to the rotatable food dispensing member or to a waste receptacle or chute

[0019] In accordance with another aspect of the invention, the automated packaging device includes a conveyor system for transporting filled individual portion-sized food containers from adjacent the filling location to a filled food container holding area, for subsequent pick-up by a human operator, for example In one embodiment, any suitable automated packaging device can be utilized

[0020] In accordance with another aspect of the present invention, an automated food carton-retrieving device is provided for retrieving and grasping individual portion-sized food containers The automated retrieving device comprises a moveable member for selectively grasping and releasing the food container In one embodiment, the retrieving device is capable of grasping and releasing an unerected food container on one side and the device further includes a second device for selectively grasping the unerected food container on the other side with structure for moving the retrieving device and the second device relatively apart when grasping the sides of the container to erect or partially erect the container

[0021] In another embodiment, an automated urging structure is provided for urging the container bottom upwardly relative to the sides of the container when the sides of the container are moved relatively apart

[0022] In accordance with another aspect of the invention, the automated modular system includes an electronic control system that receives current customer order information and the electronic control system causes the selection of a container from a plurality of different container sizes and further causes filling of food with the size of food container in response to a customer order In one aspect, the electronic control system can receive customer order information and controls the dispensing rate of food dispensed from the food dispensing module to the fry module which dispensing automatically determines the amount of food being fried without further intervention by the electronic control In one aspect, the control system can include a separate control system for each of the dispensing, fry and packaging systems or modules, each of which interface with a central control system, which in turn optionally interfaces with a POS (point-of-sale) system

[0023] In accordance with another aspect of the invention, the automated modular system is suitable for dispensing, frying and packaging French fries into individual portion-sized containers

[0024] In accordance with another aspect of the present invention, an automated method of dispensing, frying and packaging food into individual portion-sized containers is provided that includes dispensing a desired quantity portion of food to be fried from an automated dispensing module to an automated fry module and thereafter frying the portion of food dispensed from the dispensing module in the automated fry module adjacent the dispensing module to produce a quantity of fried food Thereafter, the quantity of fried food is dispensed from the fry module to a packaging module where the fried food dispensed from the fry module is packaged into individual portion-sized containers with an automated packaging module

[0025] In another aspect of the invention, the automated method further comprises seasoning the quantity of fried food with a seasoning device

[0026] In accordance with another aspect of the invention, the dispensing includes dispensing a predetermined quantity of food from the storage container into a secondary container located in a freezer and dispensing the quantity of food from the secondary container to a location outside of the freezer

[0027] In accordance with another aspect of the method of the present invention, the frying comprises a rotating fry wheel having at least a generally circular perimeter and a plurality of compartments, each compartment having an opening towards the perimeter, the food being contained in at least one of the compartments during the frying, the fry wheel being mounted for rotational movement relative to the radial axis of the fry wheel in a fry vat with the radial axis being disposed above a normal operating level of the cooking oil in the fry vat In accordance with this aspect of the invention, the automated method further includes containing a drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of angular rotation to simulate shaking of a fry basket during frying

[0028] In accordance with another aspect of the invention, the packaging includes rotating a rotatable food dispensing member having an inlet location to receive a quantity of cooked food in a discharge location to discharge cooked food, the food dispensing member being rotated to dispense food into a food dispensing chute position to receive cooked food from the discharge location of the rotatable food

dispenser and thereafter dispensing said food from the dispensing chute to a container to be filled

[0029] In accordance with another aspect of the invention, the method further includes holding an individual portion-sized carton or container positioned to receive food from the dispensing chute with an automated carton holding device

[0030] In accordance with still another aspect of the invention, the method further includes collecting food dispensed from the discharge location of the dispensing chute that is not deposited into the individual portion-sized food container with a rotatable food collecting member disposed to collect such not deposited food

[0031] In accordance with another aspect of the method, the method includes electronically coordinating the operation of the three modules or devices within an electronic control system. In one embodiment, the method further includes electronically receiving current customer order information by the electronic control system which causes selection of a container from a plurality of different sized containers and filling the container with food of the ordered size of food container in response to a customer order by the packaging module. In accordance with another aspect of the method, customer order information is electronically received and the dispensing rate of food dispensed from the food dispensing module to the fry module is controlled, which dispensing automatically determines the amount food being fried without further intervention by the electronic control system

[0032] In accordance with another aspect of the present invention, an automated dispensing device for dispensing a quantity of food to be subsequently cooked is provided. In one embodiment, the automated dispensing device includes a freezer or refrigerated compartment, a storage container located in the freezer for containing food to be dispensed, structure for dispensing a predetermined quantity of food from the storage container into a secondary or dump container, the structure for dispensing the predetermined quantity of food being located in the freezer, and structure is provided for dispensing the quantity of food from the secondary or dump container in the freezer to a location outside of the freezer.

[0033] In one embodiment, the structure for dispensing a predetermined quantity of food includes a vibratory conveyor typically located in the freezer below the storage container. The structure for dispensing may further include a device for determining or sensing the quantity of food that has been deposited in the secondary container and structure is provided for terminating the operation of the structure for dispensing when a predetermined quantity of food is sensed in the secondary container.

[0034] In accordance with another aspect of the present invention, the automated dispensing device includes structure for dispensing a predetermined quantity of food that comprises a food magazine capable of dispensing individual pieces of food on a piece by piece basis. In accordance with a more specific aspect of this embodiment, the magazine comprises dual rotatable spiral flights with the spiral flights having a spacing therebetween to allow placement of a food item, such as a chicken patty, for example, to be supported by both spiral flights

[0035] In accordance with another aspect of the invention, the magazine dispenser is suspended from a slide mechanism permitting removal of the magazine from the freezer or refrigerated compartment. A plurality of the magazines can be located on a single slide mechanism. An array of the magazines may be located in the freezer, such as a 3×5 array or a 3×4 array, for example

[0036] In one embodiment, a separate drive motor is associated with each food dispensing magazine for selectively rotating spiral flights of a magazine dispenser for dispensing a desired number of the food items. The drive motor may also be located in the freezer

[0037] In accordance with another aspect of the invention, an automated method of dispensing a quantity of food to be cooked is provided. The method includes storing food items in a storage container located in the freezer, dispensing food items from the storage container to a conveyor, conveying the food items on the conveyor to a secondary or dump container located in the freezer, monitoring the amount of food items delivered to the secondary container, terminating delivery of the food items to the secondary container when a desired amount of food items are determined to be present in the secondary container as determined by the monitoring, and dispensing the food items from the secondary container and out of the freezer by at least partially inverting the secondary container. In accordance with another aspect of this embodiment, a freezer or refrigerated compartment is not utilized

[0038] In accordance with another aspect of the present invention, a device for the automated frying of foods is provided. The device in one embodiment includes a fry vat for containing and heating cooking oil, at least one circular fry wheel having at least a generally circular perimeter and a plurality of compartments with each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the fry wheel which radial axis is disposed above the normal operating level of the frying oil in the fry vat. A drive mechanism is provided for rotating the fry wheel and a control system is included for causing the drive mechanism to periodically rotate the fry wheel back and forth through a relatively small amount of rotation (such as about 2-10°, for example) to simulate shaking of a fry basket. Such control can be accomplished electronically by devices known to those skilled in the art

[0039] In accordance with another aspect of the present invention, the small amount of rotation is in the range of from about 2° to about 20°. The back and forth rotation in one direction may be of a larger angle or amount of rotation than of the rotation in the other direction

[0040] In one embodiment, a control system is provided that causes periodic incremental rotation of the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and to move the compartments out of the cooking oil for subsequent discharge of the food from the compartment. In one embodiment, the periodic incremental rotation is based on 360° divided by the number of compartments in the fry wheel.

[0041] In accordance with another aspect of the present invention, a control system is provided for operating the drive mechanism to rotate the fry wheel in one direction to cause food deposited into one of the compartments to travel

through the cooking oil in the fry vat over a period of time to fry the food and out of the cooking oil for subsequent discharge of the food from the compartment, wherein the control system adjusts the speed of rotation based on the level of cooking oil in the fry vat. In one embodiment, the control system causes incremental periodic rotation of the fry wheel and the control system adjusts the period of time between incremental rotations based on the level of cooking oil sensed in the fry vat. The period of time between incremental rotations can also be based on the temperature of the cooking oil in the fry vat.

[0042] In accordance with another aspect of the invention, a curved baffle is provided that is disposed in the fry vat adjacent the axial periphery of the portion of the fry wheel that is disposed in the cooking oil for preventing food contained in one or more of the fry wheel compartments from falling out of the compartments.

[0043] In accordance with another aspect of the present invention, an automated method of frying food in a fry vat having a heated cooking oil contained therein is provided. The method includes placing food in a fry wheel compartment, each of the compartments having an opening towards the perimeter of the fry wheel, rotating the fry wheel so that the compartment containing the food travels submerged in the heated cooking oil and periodically rotating the fry wheel back and forth in a relatively small amount of rotation to simulate shaking of the fry basket while the food is submerged in the cooking oil. In accordance with another aspect of the method of the present invention, the method comprises rotating the fry wheel in one direction to cause the food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and to move the food out of the cooking oil for subsequent discharge of the food from the compartment, wherein the speed of said rotating is related to the level of cooking oil in the fry vat. In accordance with this aspect of the present invention, the rotating may comprise incremental periodic rotation with the period of time between incremental periodic rotations being based on the level of cooking oil sensed in the fry vat. The period of time between incremental periodic rotations may also be based on the temperature of the cooking oil in the fry vat.

[0044] In accordance with another aspect of the present invention, an automated method of packaging cooked food, which may be food such as French fries, chicken nuggets and other types of food, in an individual portion-sized container is provided. The method includes delivering a quantity of a cooked food to a rotatable dispensing member, rotating the dispensing member to cause the food items to fall from one or more compartments of the dispensing member into a food dispensing chute and thereafter dispensing the food from the chute and depositing the food into the individual portion-sized food container.

[0045] In accordance with one aspect, the method may further include weighing the food in the chute before dispensing the food to the container.

[0046] In accordance with another aspect of the invention, the method includes applying seasoning to the food and may further include applying the seasoning by using gravity to cause the seasoning to travel through a nozzle and onto the food.

[0047] In accordance with another aspect of the invention, the method further includes shaking the individual portion-sized food container after the dispensing. The shaking may be automated and can include back and forth movement of the container through an arc as desired, and may be in a generally vertical axis. The arc may be a generally circular arc and the rotating back and forth may encompass an arc in the range of from about 3° to about 20°. In addition, the container may be raised and lowered before, during or after the rotating to further simulate shaking or in connection with further container handling.

[0048] In accordance with another aspect of the invention, when dispensing food from the chute to the individual portion-sized container, some of the dispensed food is not deposited into the individual portion-sized container and the method further includes collecting the not deposited food. Typically, the not deposited food will be collected in a collection device that returns the not deposited food to the chute for subsequent dispensing. In one embodiment, the collection member is rotatable and can be rotated to deposit the collected food to the chute. This helps to ensure that the not deposited food is subsequently deposited into a container on a first-in, first-out or a generally first-in, first-out basis.

[0049] In accordance with another aspect of the present invention, an automated method of packaging food, including food such as French fries, in an individual portion-sized container is provided that includes delivering a quantity of food to a food dispensing chute, selecting and holding with an automated device an individual portion-sized container of a desired size from a plurality of different sizes of individual portion-sized containers that can be selected and held by the automated device. The selected individual portion-sized container is moved by the automated device to a location for receiving food from the dispensing chute and food is dispensed from the chute and into the container. The method may further include depositing the filled food container onto a conveyor by operation of the automated device and transporting the deposited container by the conveyor to a human operator food pickup location.

[0050] In accordance with another aspect of the foregoing method, the individual portion-sized food container is unerected and the method further includes after the selecting, erecting the selected individual portion-sized food container by the automated device. In one embodiment, the automated device includes a partial vacuum suction device for holding the individual portion-sized food container and the holding includes applying a partial vacuum through a suction device to the food container. The food container can be released by reducing or eliminating the vacuum applied by the suction device to the food container sufficiently to cause the food container to be disengaged from the automated device.

[0051] In accordance with another embodiment of the method, the filled food container is placed in an upright position on a transportable member or container-receiving receptacle which in one embodiment contains a single food container and is maintained in an upright position on the transportable member by cooperation of the recessed volume of the transportable member and the food container.

[0052] In accordance with another aspect of the invention, the transporting is performed by a magnetic conveyor.

[0053] In accordance with still another aspect of the invention, an automated device for packaging cooked food

into a desired container, which may be an individual portion-sized food container is provided The device includes a rotatable food dispensing member having an inlet location to receive a quantity of the cooked food and a discharge location to discharge the cooked food A food dispensing chute is positioned to receive the cooked food from the discharge location of the rotatable food dispenser and the dispensing chute has a discharge location. In one embodiment, the dispensing chute has a food holding area for holding a quantity of the cooked food deposited therein A suitable weighing device can be associated with the dispensing chute to weigh the food that is contained in the chute or in the holding area of the chute. In one embodiment, the weighing device is a load cell

[0054] In accordance with another aspect of the invention, the automated device includes a food carton or container holding device for holding the food carton in position to receive food from the discharge location of the dispensing chute The carton holding device can include an axially rotatable generally vertically extending elongated first member and a second member that extends from the elongated member, the second member having a gripping member for gripping a food container, which may be an individual portion-sized food container In one embodiment, the gripping member comprises a suction cup A vacuum source may be supplied to the suction cup to create at least a partial vacuum, allowing the container to be held In one embodiment, the carton holding device is capable of moving the food container through an arc of about or of at least about 180° and in which the carton holding device is capable of moving the food container up and down

[0055] In accordance with another aspect of the present invention, the automated device comprises a conveyor system for transporting filled individual portion-sized food containers from adjacent the filling location to a filled container holding area The conveyor system may comprise in one embodiment a continuous loop raceway and a plurality of discrete moveable food container receptacles that are moveable along the raceway The conveyor system may include a continuous moveable loop having at least one magnetic element capable of magnetically attracting one of the moveable receptacles at a time for causing movement of the receptacle corresponding to movement of the magnetic element A plurality of the magnetic elements may be spaced apart along the moveable loop

[0056] In one embodiment, structure is provided for preventing movement of the discrete receptacles when the structure for moving the discrete receptacles along the raceway is activated The structure for preventing movement can be a barrier that is disposed across the raceway. In one embodiment, the barrier is selectively moveable and in another embodiment the barrier is fixed. In one embodiment, the barrier prevents movement of the receptacles only for a receptacle that has a food carton or container disposed thereon. In this embodiment, the barrier may be located at a height that is above the top of the receptacles located on the conveyor system adjacent the barrier

[0057] In accordance with another aspect of the invention, an automated device is provided to retrieve and grasp a food container, which may be an individual portion-sized food or French fry container or carton The automated retrieving device includes a member for selectively grasping and releasing the food container and for moving the moveable member horizontally and linearly

[0058] In accordance with another aspect of the invention, a magazine is provided for holding a plurality of food containers in an unerected state

[0059] In accordance with another aspect of the invention, the automated device includes a retrieving device that is capable of grasping and releasing an unerected food container on one side and further includes a second device for selectively grasping the unerected food container on the other side. A structure for moving the retrieving device and the second device relatively apart when grasping the sides of the container is provided. The automated device may further include an automated urging means for urging the container bottom upwardly relative to the sides of the container when the retrieving device and the second device are moved relatively apart when grasping the container

[0060] In accordance with another aspect of the invention, the food dispensing member is a rotatable wheel having an open central area and an outer at least generally circular rim The rotatable wheel has a plurality of open compartments spaced apart about the circular rim that extend inwardly from the circular rim and open interiorly of the circular rim A baffle may be provided to prevent food contained in the one or more of the open compartments from falling out of the compartments when the wheel is rotated until the compartment is in position over the food dispensing chute The baffle may be curved to follow the curvature of the inner part of the wheel and may also be perforated The automated device may further include a rotatable food collecting member that is disposed to collect food dispensed from the discharge location of the dispensing chute which food is not deposited into a container held in position at the discharge location Typically, the collection member will have a discharge location to discharge collected food. In one embodiment, the discharge location is the food dispensing chute. The collecting member may be a rotatable food collecting wheel having an open central area and an outer circular rim having a plurality of open compartments spaced apart about the circular rim that extend inwardly from the circular rim and that are open towards the rim interior The rotatable food dispensing member and the rotatable food collecting member can be rotatable in one direction to discharge food at a discharge location and into a food dispensing chute and can be rotatable in an opposite direction to discharge the food at a second discharge location which may be to a waste chute The discharge to the waste chute feature can be activated, for example, when the food is held in the dispensing device for too long a period of time

[0061] The packaging device may also include an automated seasoning device for depositing a predetermined quantity of seasoning to food contained in the packaging device

[0062] In accordance with another aspect of the invention, the device for applying seasoning includes a seasoning delivery tube having an inlet and a discharge location A seasoning delivery head is positioned to deliver seasoning to the food to be seasoned with the head in communication with the outlet of the delivery tube and located below the inlet of the delivery tube Structure is provided for depositing a predetermined quantity of seasoning into the inlet of the delivery tube so that the quantity of seasoning falls by

gravity through the delivery tube and into and through the seasoning head and onto the food to be seasoned Typically, the structure for depositing the predetermined quantity of seasoning will receive seasoning from a bulk hopper by gravity feed The quantity of seasoning to be dispensed can be determined volumetrically, for example

BRIEF DESCRIPTION OF THE DRAWINGS

[0063] **FIG. 1** is a perspective view of an automated food processing system in accordance with the invention;

[0064] **FIG. 2** is a perspective view of an alternate embodiment of a food processing system in accordance with the present invention;

[0065] **FIG. 3** is a schematic view, partly in section, of the food processing system of **FIG. 1**;

[0066] **FIG. 4** is a side elevation view of a portion of a bulk food dispensing device in accordance with the present invention;

[0067] **FIG. 4A** is a side elevation view, partly in section, of an alternative embodiment for a portion of the dispensing device illustrated in **FIG. 4**;

[0068] **FIG. 5** is a top plan view of a portion of the bulk food dispensing device in accordance with the present invention;

[0069] **FIG. 6** is a side elevation view, partly in section, of a bulk food dispensing device in accordance with the present invention and also illustrating a portion of a device for frying food in accordance with the present invention;

[0070] **FIG. 7** is a perspective view of a magazine-type dispenser that can form part of the food dispensing device of the present invention;

[0071] **FIG. 8** is a partial side elevation view of the magazine dispenser of **FIG. 7**;

[0072] **FIG. 9** is a perspective view of a magazine-type dispenser array that can be utilized in the dispenser of the present invention;

[0073] **FIG. 10** is a fragmentary view of the device of **FIG. 9**;

[0074] **FIG. 11** is a top plan view of a food frying device in accordance with the present invention;

[0075] **FIG. 12** is a front elevation view of the food frying device of **FIG. 11**;

[0076] **FIG. 13** is a partial fragment sectional view along line **13-13** of **FIG. 11**;

[0077] **FIG. 14** is a fragmentary sectional view of a portion of the food frying device of **FIG. 11**;

[0078] **FIG. 15** is a sectional view along line **15-15** of **FIG. 14**;

[0079] **FIG. 16** is a perspective view of a drive mechanism for the food frying device of **FIG. 11**;

[0080] **FIG. 17** is a fry basket for use in the frying device of **FIG. 11**;

[0081] **FIG. 18** is a fragmentary sectional view along line **18-18** of **FIG. 17**;

[0082] **FIG. 19** is an enlarged, fragmentary elevation sectional view of a portion of **FIG. 13**;

[0083] **FIG. 20** is an alternate view along line **13-13** of **FIG. 11**;

[0084] **FIG. 21** is a sectional view along line **21-21** of **FIG. 20**;

[0085] **FIG. 22** is an enlarged fragmentary view of a portion of **FIG. 21**;

[0086] **FIG. 23** is an alternate embodiment of a fry wheel in accordance with the present invention;

[0087] **FIG. 24** is another alternate embodiment fry wheel in accordance with the present invention;

[0088] **FIG. 25** is a front perspective view of a packaging device in accordance with the invention;

[0089] **FIG. 26** is a rear perspective view of the device of **FIG. 25**;

[0090] **FIG. 27** is a top plan view of the device of **FIG. 25**;

[0091] **FIG. 28** is a side elevation view, partially in section and partially broken away of the packaging device of **FIG. 25**;

[0092] **FIG. 29** is a front elevation view of the device of **FIG. 25**;

[0093] **FIG. 30** is a front perspective view of a portion of an automated container handling system in accordance with the invention;

[0094] **FIG. 31** is a top plan view of the container handling system of **FIG. 30**;

[0095] **FIG. 32** is a side elevation view, partially broken away of the automated container handling system of **FIG. 30**;

[0096] **FIG. 33** is a rear elevation view of the container handling system of **FIG. 30**;

[0097] **FIG. 34** is a front perspective view of the container handling system of **FIG. 30** shown in another operative position;

[0098] **FIG. 35** is a top plan view of the container handling system of **FIG. 34**;

[0099] **FIG. 36** is a side elevation view, partially broken away of the container handling system of **FIG. 34**;

[0100] **FIG. 37** is a rear elevation view of the container handling system of **FIG. 34**;

[0101] **FIG. 38** is a front elevation view of a portion of a container handling apparatus in accordance with the invention;

[0102] **FIG. 39** is a front elevation view of another portion of the container handling apparatus of **FIG. 34**;

[0103] **FIGS. 40-42** illustrate a front diagrammatic elevation view illustrating a portion of the container handling apparatus in accordance with the invention;

[0104] **FIGS. 43-44** illustrate a side elevation view, partly in section, of a portion of the food packaging apparatus in accordance with the invention;

[0105] FIG. 45 is a top plan view of a food packaging device in accordance with the present invention;

[0106] FIG. 46 is a perspective view of a container-receiving receptacle in accordance with the present invention;

[0107] FIG. 47 is a top plan view of the device of FIG. 47;

[0108] FIG. 48 is a sectional view along line 48-48 of FIG. 47;

[0109] FIG. 49 is a cross-sectional view along line 49-49 of FIG. 47 and further including a portion of a conveyor system in accordance with the present invention;

[0110] FIG. 50 is a sectional view along line 50-50 of FIG. 49;

[0111] FIG. 51 is a front elevation view of a carton useful in accordance with the present invention;

[0112] FIG. 52 is a rear elevation view of a carton useful in accordance with the present invention;

[0113] FIG. 53 is a sectional view along line 53-53 of FIG. 52;

[0114] FIG. 54 is a bottom plan view of the container of FIG. 51;

[0115] FIG. 55 is a sectional view along line 55-55 of FIG. 57;

[0116] FIG. 56 is a perspective view showing use of the food container of FIG. 51;

[0117] FIG. 57 is a perspective view of a food container useful in accordance with the present invention;

[0118] FIG. 58 is an alternate embodiment perspective view of a container useful in accordance with the invention;

[0119] FIG. 59 is a development view of the carton of FIG. 51;

[0120] FIG. 60 is a side elevation view of the carton of FIG. 51;

[0121] FIG. 61 is a sectional view of a portion of the food packaging device of FIG. 25;

[0122] FIG. 62 is a sectional view of a portion of a food storage device in accordance with the present invention;

[0123] FIG. 63 is a sectional view of the food storage device of FIG. 62;

[0124] FIG. 64 is a side elevation view, partly in section, a hood system in accordance with the present invention;

[0125] FIG. 65 is a perspective view of an automated seasoning device in accordance with one aspect of the invention;

[0126] FIG. 66 is a side elevation view of the seasoning device of FIG. 65;

[0127] FIG. 67 is a front elevation view of the seasoning device of FIG. 65;

[0128] FIG. 68 is a top plan view of the seasoning device of FIG. 65;

[0129] FIG. 69 is a diagrammatic view of a control system in accordance with the present invention;

[0130] FIG. 70 is a diagrammatic view of a control system in accordance with the present invention;

[0131] FIG. 71 is a diagrammatic view of a frying cycle in accordance with the present invention;

[0132] FIG. 72 is a schematic illustration of a sample touch screen monitor useful in accordance with the invention; and

[0133] FIG. 73 depicts another touch screen layout in accordance with the present invention

DETAILED DESCRIPTION OF THE INVENTION

[0134] General

[0135] In accordance with the present invention, an automated food processing system and method is provided. The automated food processing system and method in accordance with the invention allows food to be dispensed, fried and packaged in a suitable container or alternatively dispensed to a food holding area for subsequent processing by a human operator

[0136] Referring to the Figures generally and in particular to FIGS. 1 and 3, there is illustrated an automated food processing system 100 in accordance with the invention. Automated food processing system 100 includes a food dispensing device 200, a fry device 400 and a food packaging device 600. In accordance with one embodiment of the present invention, each of dispensing, fry and packaging devices 200, 400 and 600, respectively, can be constructed and are sometimes illustrated in "modular" construction or form. By "modular" construction or form it is meant that dispensing, fry and packaging devices 200, 400 and 600, respectively, can exist and be contained in separate cabinets, for example, and also operate independently of the other devices. Thus, if one of dispensing, fry and packaging devices 200, 400 and 600, respectively, are inoperative or are otherwise deactivated, the function of the deactivated or inoperative device can be performed manually. For example, food to be fried could be manually dispensed in place of dispensing device 200. Alternatively, food to be fried could be fried in a conventional fry vat after being dispensed from dispensing device 200 in place of using fry device 400 and food that is dispensed and fried in dispensing and fry devices 200 and 400, respectively, could, in turn, be packaged manually, for example.

[0137] To facilitate such modular construction and use, each of dispensing, fry and packaging devices 200, 400 and 600, respectively, can be contained in a separate wheeled cabinet, 202, 402 and 602, respectively, as illustrated in FIG. 1. Alternatively, dispensing, fry and packaging devices 200, 400 and 600, respectively, could be mounted as a single unit or in a single cabinet or in "non-modular form," as desired, or more than one of such devices 200, 400 and 600 could be so mounted or combined

[0138] A suitable control system for the dispensing, fry and packaging devices is also provided. As will be described more completely hereafter, in one embodiment, the control system includes a central control system 110 that can interface with a point-of-sale system 112. The central control system will communicate with separate subcontrol systems 114, 116 and 118, one for each of the dispensing, fry and

packaging devices **200**, **400** and **600**, respectively Alternatively, a single central control system (not shown) could be utilized in place of individual control systems for each of devices **200**, **400** and **600** Similarly, as another alternative, a single central control system could be utilized to control the overall operation of automated food processing system **100** as well as controlling the individual functions and aspects of dispensing, fry and packaging devices **200**, **400** and **600**

[0139] The basic operations of dispensing device **200**, fry device **400** and food packaging device **600** will now be briefly discussed and discussed in detail hereafter

[0140] Briefly, dispensing device **200** functions to dispense a quantity of food to be fried to fry device **400** In one aspect of the invention, any suitable food dispensing device can be utilized Dispensing device **200** can include a cabinet **202** to house the components of dispensing device **200** In one embodiment, cabinet **202** will be refrigerated, preferably below 32° F so that the food contents therein will remain frozen This allows the food stored in dispensing device **200** to remain therein for a long period of time, much longer than if the contents were merely refrigerated (above freezing) or merely at room temperature

[0141] In the illustrated embodiment, dispensing device **200** includes an uncooked bulk food dispensing container **204** Uncooked bulk food dispensing container **204** may be utilized for food such as French fries or chicken nuggets, for example Other types of food may also be contained in a dispenser such as uncooked bulk food dispensing container **204** Typically, those types of food would be in the form of relatively small pieces compared to relatively large food pieces such as chicken patties, for example

[0142] For relatively large food pieces, a large food dispensing container is utilized In one embodiment, the large food dispensing container is in the form of a magazine food dispenser **206**

[0143] Food dispensed from a dispenser of dispensing device **200** is deposited on a conveyor **208** that, in turn, directs the deposited food to a secondary or dump container **210** for subsequent discharge from dispensing device **200**

[0144] In the illustrated embodiment, uncooked bulk food dispensing container **204**, magazine food dispenser **206**, conveyor **208** and secondary container **210** are contained in cabinet **202**, which is a refrigerated environment, preferably maintained below freezing (32° F or lower).

[0145] While any suitable conveyor can be utilized in one aspect, conveyor **208** is preferably a vibratory conveyor, vibrated by a suitable vibratory mechanism that vibrates a conveyor body **214** Conveyor body **214** may take the form of a suitably shaped tray, for example

[0146] By containing the foregoing components in a refrigerated and preferably frozen environment, consistency in food preparation and dispensing is achieved, thereby contributing to the overall efficient, effective and uniform performance of automated food processing system **100**

[0147] Secondary container **210** can be of a form as desired and includes suitable weighing mechanism **216** to permit a determination of the quantity of food contained in secondary container **210** Weighing mechanism **216** can be any suitable device to weigh the contents or otherwise determine the amount of food in secondary container **210** Weighing mechanism **216** may comprise a load cell or a mechanism for determining the volume of food deposited into secondary container **210**, for example In this manner, the amount of food that is charged to fry device **400** at a particular time can be determined In addition, weighing mechanism **216** can be operated during operation of conveyor **208** and the operation of conveyor **208** continued until a desired amount of food is deposited in secondary container **210** In this manner, a precise amount of food can be delivered to secondary container **210** thereby permitting consistency and uniformity in the portion of food that is delivered to fry device **400** This is also important to ensure that a sufficient quantity of food is being cooked by automated food processing system **100**

[0148] Prior to activation of dumping mechanism **218**, discharge door **220** of cabinet **202** is opened by operation of a door opening device which can be any suitable device as desired and in the illustrated embodiment is a cylinder **222** attached to discharge door **220** and moveable up and down in the direction of arrow B Cabinet **202** is preferably insulated with a suitable insulating material **224** that is also provided in discharge door **220** The provision of a suitable insulating material is important, particularly since dispensing device **200** will typically be located proximate or adjacent fry device **400** that operates at a substantially elevated temperature, thereby typically generating substantial heat

[0149] In the illustrated embodiment, dispensing device **200** includes four dispensing lanes from which food is discharged from dispensing device **200** and to a suitable location such as fry device **400**. After dispensing through discharge door **220**, cylinder **222** is activated to close discharge door **220** Similarly, dumping mechanism **218** of secondary container **210** is activated to return secondary container **210** to its upright position to receive more food

[0150] Fry device **400** includes a fry wheel **404**, a fry vat **406** for containing and heating a suitable cooking oil and a drive mechanism **408** for suitably rotating fry wheel **404** It is to be understood that in accordance with one aspect of the invention any suitable frying device can be utilized

[0151] In the illustrated embodiment of **FIGS. 3 and 11-16**, fry device **400** includes a plurality, in this case four, of separate fry wheels **404**, **410**, **412** and **414**, as well as four separate fry vats **416**, **406**, **420** and **418** and a separate drive mechanism **408** for each fry wheel, each dedicated to a particular one of fry wheels **404**, **410**, **412** and **414**.

[0152] In one embodiment, a separate drive mechanism is provided for each of fry wheels **404**, **410**, **412** and **414** and can be suitably located in cabinet **402**, preferably in a location that is above the level of cooking oil present in the associated one of fry vats **416**, **406**, **420** and **418**, respectively

[0153] The suitable rotation of each of fry wheels **404**, **410**, **412** and **414** can be as desired to direct food articles loaded therein down and through the fry vat until reaching the other side of the fry vat whereupon the food articles are discharged The rotation can be either continuous or a periodic incremental rotation For example, a suitable drive mechanism can be provided to periodically rotate fry wheel **410** in a desired rotational increment, which may be based on the number of compartments contained in fry wheel **410**

In the illustrated embodiment of FIG. 13, for example, fry wheel 410 comprises eight food compartments 422, 424, 426, 428, 430, 432, 434, and 436. Each of food compartments 422-436 is a perimeter food compartment and open to the perimeter or exterior of fry wheel 410. Each of fry wheels 404, 412 and 414 can be similarly configured.

[0154] As described in more detail hereafter, each of compartments 422-436 is formed from a perforated curved compartment forming member 510.

[0155] In the rotation of fry wheel 410, a periodic incremental rotation can be based upon 360° divided by the number of compartments. Thus, for example, in the illustrated embodiment of FIG. 13, each periodic rotation would consist of a rotation of 360° divided by eight compartments or a periodic rotation increment of 45°. Thus, as illustrated in FIG. 13, the food contained, in this case French fries, in compartments 424-430 would remain in cooking oil 454 contained in fry vat 406 for all or part of four incremental rotations, after which the food would be discharged from fry wheel 410 in the next incremental rotation thereof. For example, as illustrated in FIG. 13, compartment 422 is ready to receive a charge of food to be fried, compartment 424 has a charge of food that has been just immersed in cooking oil 454. Cooking oil 454 is at a level H as illustrated in FIG. 13, which is dependent upon the amount of food contained in compartments 422-436 that are submerged in cooking oil 454.

[0156] Similarly, compartment 426 has food contained therein that has gone through two incremental 45° rotations of fry wheel 410, compartment 428 has food contained therein that has undergone three incremental rotations and food compartment 430 has food contained therein that has undergone four incremental rotations of fry wheel 410 and compartment 432, which is now empty, has discharged the food contained therein upon the last incremental rotation of fry wheel 410. Thus, upon the next incremental rotation of fry wheel 410, which is in the clockwise direction as shown by arrow B of FIG. 13, the food contained in food compartment 430, which in this case is a quantity of French fries 455, will be discharged from compartment 430 to the food packaging device which is hereafter briefly described.

[0157] Upon discharge of food, which in this case is a quantity of French fries from one of compartments 422-436 of a fry wheel, such as fry wheel 410 as illustrated in FIG. 3, the food is deposited onto an inlet chute 604 of food packaging device 600.

[0158] From inlet chute 604, the food from inlet chute 604 received from fry wheel 410 is deposited into rotatable food dispensing member 606. Typically, rotatable food dispensing member 606 will be compartmented into a plurality of compartments that are arrayed along the periphery of rotatable food dispensing member 606.

[0159] Rotatable food dispensing member 606 has a discharge location to discharge the food deposited therein. The discharge location is generally located towards an upper portion of rotatable food dispensing member 606. A food dispensing chute mechanism 608 is positioned to receive cooked food from the discharge location of rotatable food dispensing member 606. In a preferred embodiment, food dispensing chute mechanism 608 incorporates a device for weighing or otherwise determining the quantity of food that has been deposited into food dispensing chute mechanism 608. This ensures that when food is dispensed from food dispensing chute mechanism 608 a minimum quantity of food will be dispensed, thereby ensuring that a container 611 or other package that is to receive the food from mechanism 608 will receive a desired charge.

[0160] Food packaging device 600 preferably also includes a suitable automated container handling system 610. Automated container handling system 610 is capable of, in a preferred embodiment, selecting container 611 of a desired size, retrieving and grasping container 611, erecting unerected container 611 into an erected form and holding the erected container 611 in position to receive food dispensed from food dispensing chute mechanism 608.

[0161] After food container 611 receives food from food dispensing chute mechanism 608, automated container handling system 610 is capable of moving container 611 having food deposited therein to a container receiving receptacle 612 which receptacle 612 can be transported via a conveyor system 614 to a desired location for subsequent pickup of container 611 having food contained therein by a human operator, for example.

[0162] Preferably, a food overflow collection member is provided to collect any food dispensed by food dispensing chute mechanism 608 that is not deposited into container 611. In one embodiment, the overflow food collection device is a rotatable food collection member 613. Overflow food collection member 613 functions to collect food dispensed by food dispensing chute mechanism 608 that is not received in container 611 and to recycle food collected by overflow food collection member 613 into food dispensing chute mechanism 608 for subsequent dispensing to a container in a first-in, first-out manner so that overflow food is promptly recycled to dispensing chute 608 for dispensing to a container.

[0163] Preferably, food packaging device 600 is configured to include a provision by which food contained in dispensing device 600 is routed to waste where it is not desired to dispense such food into a food container. Such a condition could arise, for example, if food is held for too long a period in food packaging device 600. This function may be accomplished, for example, by providing a waste discharge location which can be in the form of a waste chute 615 to which food from rotatable food dispensing member 606 and overflow food collection member 613 can be directed. In one embodiment, chute mechanism 608 is lowered and member 606 is rotated to dispense food to chute mechanism 608, which in turn dispenses into member 613. Member 613 is rotated counterclockwise to deliver food to waste chute 615. This process can be continued until all of the food in device 600 is so emptied, if desired.

[0164] Preferably, a suitable structure for applying a desired quantity of seasoning to food contained in food packaging device 600 is provided. In the embodiment illustrated in FIG. 3, a food seasoning device 616 is provided. Food seasoning device 616 can be any suitable seasoning device as desired. In one embodiment, food seasoning device 616 dispenses a desired quantity of seasoning from a bulk storage container through a delivery tube and onto food located in rotatable food dispensing member 606.

[0165] Preferably, and in the embodiment illustrated in FIG. 3, a food seasoning device 616 is provided that directs

a desired quantity of seasoning onto food that is contained in a bottom portion of rotatable food dispensing member **606** and inlet chute **604** via a seasoning dispensing head **618**

[0166] Preferably, conveyor system **614** is composed of a raceway **620** that is an endless loop around the periphery of the top surface of cabinet **602** of food packaging device **600**, which in one embodiment can be a modular, wheeled cabinet. Conveyor system **614** causes container receiving receptacle **612** to travel around raceway **620** to a food container pickup location **622** where a human operator can pickup food containers having food therein. Preferably, conveyor system **614** includes structure for stopping movement of a container/receiving receptacle **612** at a predetermined location when carrying a food container, such as at food container pickup location **622**. Such structure in one embodiment may comprise a gate structure **928** or **928'** of **FIG. 45** and **FIGS. 25-27**, respectively, that extends across at least a portion of raceway **620** in the vicinity of the predetermined location. Any suitable type of barrier structure can be utilized to prevent the desired movement. Most preferably, gate structure **928** or **928'** will be located at a height that is above the top of the receptacle when located on conveyor system **614** so that movement of container/receiving receptacle **612** is prevented or stopped only for a receptacle **612** that has a food container **611** disposed thereon. Note that the pickup location can be configured as desired and slightly different configurations **622** and **622'** are shown in **FIG. 45** and **FIGS. 25-27**, respectively.

[0167] Referring to **FIG. 2**, there is illustrated an alternate embodiment of an automated food processing system **101** in accordance with the invention. Automated food processing system **101** includes a food dispensing device **201** which is similar to food dispensing device **200**, previously briefly described, where like reference numerals represent like elements. Food dispensing device **201** includes fewer uncooked bulk food dispensing containers **204** and additional magazine food dispensers that are similar to magazine food dispenser **206**, previously referred to. Otherwise, dispensing device **201** is similar to dispensing device **200** previously described.

[0168] Automated food processing system **101** also includes fry device **400**, which has been described.

[0169] One primary distinction between automated food processing system **100** and automated food processing system **101** is that automated food processing system **101** does not include-an automated packaging device such as automated packaging device **600**. In place of food packaging device **600**, a food storage device **635** is provided. Food storage device **635** allows food cooked by food frying device **400** to be stored in a heated environment for subsequent manual processing. As configured in **FIG. 2**, food storage device **635** includes separate heated product receiving receptacles **637**, **639**, **641** and **643**. Each receptacle **637**, **639**, **641** and **643** is dedicated to receiving food from a respective one of fry wheels **410**, **412**, **414** and **404**, respectively. In addition, each receptacle **637-643** can have placed therein a suitable container to receive food, such as handled trays **645**, **647**, **649** and **651**.

[0170] As illustrated in **FIG. 2**, a food item F is being discharged from fry wheel **414** down a chute **653** and into handled tray **649** contained within heated receptacle **641**. Food item F can be stored therein for a period of time until it is ready for subsequent processing.

[0171] Food Dispensing Device

[0172] Referring to the Figures generally and in particular to **FIGS. 1-10**, there is illustrated various embodiments of food dispensing devices and portions thereof in accordance with the invention.

[0173] In one embodiment, food dispensing device **200** is illustrated or partially illustrated in **FIGS. 1 and 3-8**. Food dispensing device **200** includes a cabinet **202**, bulk uncooked food dispensing containers **204**, **205** and **207**, magazine food dispenser **206**, **209**, **211** and **213**, and a suitable conveyor system for each lane **234**, **236**, **238** and **240** of food dispensing device **200**. Any suitable number of magazine dispensers can be used for a particular lane, such as one, two, three, four, five or more, and the illustrated embodiment of four is merely an example. As configured in **FIG. 1**, for example, lane **234** receives material from bulk hopper **204**, lane **236** receives food material from bulk hopper **205**, lane **238** receives food material from bulk hopper **207** and lane **240** receives dispensed food from magazine food dispensers **206**, **209**, **211** and **213** as will be described hereinafter in greater detail, particularly with respect to food dispensing device **201** of **FIG. 2**, for example.

[0174] Each lane **234**, **236**, **238** and **240** dispenses food that is subsequently directed to fry wheels **410**, **412**, **414** and **404**, respectively.

[0175] The components of lane **238** will now be described in detail and it is to be understood that the components of lanes **234** and **236** are similar. Lane **238** includes uncooked bulk food dispensing container **207** and a food handling system **242** which in this embodiment is identical for each lane **234**, **236**, **238** and **240** as well as for each lane of food dispensing device **201**. It should be noted that food handling system **242**, as for example, illustrated in **FIGS. 3-6** is depicted with respect to lane **240** and that food handling system **242** is the same for each lane **234**, **236**, **238** and **240**.

[0176] Food handling system **242** includes conveyor system **208**, secondary container **210**, weighing mechanism **216** and dumping mechanism **218**. Conveyor system **208** includes vibratory mechanism **212** and conveyor body **214**.

[0177] Uncooked bulk food dispensing container **204** can be of a shape and dimension generally as desired. Preferably, uncooked bulk food dispensing container **204** has an upper opening to permit a supply of food to be placed in uncooked bulk food dispensing container **204**. Upper opening **244** as illustrated is located in an upper rear portion of uncooked bulk food dispensing container **204** and can be conveniently accessed via a rear door **246** of cabinet **202**. Rear door **246** preferably is insulated with suitable insulation material **224**.

[0178] Uncooked bulk food dispensing container **204** is composed of a pair of opposed upper sidewalls **248**, a pair of generally opposed lower sidewalls **250** and front and rear walls **252** and **254**, respectively, which connect together upper sidewalls **248** and **250** to provide uncooked bulk food dispensing container **204**. Front sidewall **252** includes a lower portion **252'** that extends inwardly from top to bottom to further facilitate discharge of food contained in uncooked bulk food dispensing container **204**. Preferably, lower generally opposed sidewalls **250** are slightly indented from top to bottom to facilitate the discharge of food that may be contained therein.

[0179] Uncooked bulk food dispensing container **204** includes a bottom opening **256** that permits the discharge of food contained therein Bottom opening **256** can be configured as desired and in the illustrated embodiment the entire bottom of uncooked bulk food dispensing container **204** is open In the illustrated embodiment, uncooked bulk food dispensing container **204** is particularly suited for use with food such as French fries and chicken nuggets as well as other types of food of relatively small size

[0180] Uncooked bulk food dispensing container **204** is suitably mounted within cabinet **202** While a suitable mounting structure can be utilized, it is preferred to utilize a structure that will minimize heat transfer from the exterior and through cabinet **202** to uncooked bulk food dispensing container **204**, particularly where cabinet **202** is refrigerated, especially where temperatures below freezing are utilized In that regard, front mounting bracket **258** and rear mounting bracket **260** each are configured to minimize heat transfer from cabinet **202** to uncooked bulk food dispensing container **204** In that regard, front mounting bracket **258** and rear mounting bracket **260** include openings, **258'** and **260'**, respectively, to minimize such heat transfer and to maximize airflow around the containers **204**, **205**, **207** and dispensers **206**, **209**, **211** and **213** Similarly, materials of low thermal conductivity can also be utilized, if desired, for brackets **258** and **260** Generally, to minimize heat transfer and to maximize airflow, the surface area contact and cross-sectional area of mounting brackets **258** and **260** should be minimized to reduce heat transfer and "hot spots" on uncooked bulk food dispensing container **204**

[0181] As illustrated in **FIGS. 3 and 4**, for example, food contained in uncooked bulk food dispensing container **204** passes through bottom opening **256** and onto conveyor body **214** which in the illustrated embodiment is a suitably dimensioned pan Conveyor body **214** is suitably mounted to vibratory mechanism **212** to effect vibration of conveyor body **214** as well as food contained therein and food contained in uncooked bulk food dispensing container **204**, and in particular the lower portion of container **204** This vibration facilitates the discharge of food from uncooked bulk food dispensing container **204** and causes food contained in conveyor body **214** to travel in the direction of arrow G Any suitable conveyor system can be used in accordance with one aspect of the invention

[0182] A preferred type of vibratory mechanism is available from FMC Technologies, Inc of Chicago, Ill marketed under the model F-010-B and DF-010-B Vibratory mechanism **212** is preferably an electromagnetic vibrating mechanism Vibratory mechanism **212** in one embodiment produces a vibrating stroke at the surface of conveyor body **214** The stroke results from the action of an electromagnet that pulls conveyor body **214** sharply down and backward and then allows it to spring up and forward Typical vibratory mechanisms of this type run at about 3,600 vibrations/minute at 60 Hz power The power of the vibrating stroke can be controlled by a suitable drive module as is known in the art In one embodiment, vibratory mechanism **212** can be operated at about 85% of full power during filling of secondary container **210** with food For the first part of a fill cycle of secondary container **210**, vibratory mechanism **212** can be run continuously, then pulsed by turning its power on and off periodically so that vibratory mechanism **212** operates about 50% of the time to finish filling secondary container **210** with a desired quantity of food, thereby providing better control on the last part of the food charged to secondary container **210**

[0183] Food dispensing device **200** preferably includes a suitable mechanism to determine the weight or volume of a charge of food delivered by conveyor system **208** to secondary container **210** The amount may be determined either by weight or volume, for example In the illustrated embodiment, weighing mechanism **216** is operatively interfaced with secondary container **210** to provide an indication of the weight of food contained in secondary container **210** The weight sensed in secondary container **210** by weighing mechanism **216** is communicated with control system **114** of food dispensing device **200** Control system **114** monitors and controls the operative functions of food dispensing device **200** as hereinafter described in greater detail

[0184] Optionally, a level sensor can be employed in uncooked bulk food dispensing container **204** to provide an indication of the amount of food stored therein that is available for dispensing Any suitable level indicator known in the art can be utilized in accordance with the invention such as photoelectric, weight, turning fork and others, for example

[0185] Secondary container **210** can be considered as a dump container and as associated therewith, dumping mechanism **218** for rotating secondary container **210** through an arc as indicated by arrow B sufficiently to dump the contents of secondary container **210** Any suitable dumping mechanism can be utilized Illustrated dumping mechanism **218** includes a dump cylinder **264** that is secured to a base **266** Dump cylinder **264** can selectively rotate a drive gear or wheel **268** that, in turn, is operatively associated with a follower gear or wheel **270** to cause rotation of follower gear or wheel **270** Secondary container **210** is rigidly secured to follower gear or wheel **270** so that when follower gear or wheel **270** is rotated by drive gear or wheel **268** secondary container **210** is rotated through an arc that causes secondary container **210** to rotate forward to a dumping position as illustrated in phantom lines in **FIG. 3** indicated by reference numeral **210'** Such movement is caused by extension of dump cylinder **264** Similarly, retraction of dump cylinder **264** moves secondary container **210** from the dump position indicated by reference numeral **210'** to the upright position indicated by reference numeral **210** in **FIG. 3** where secondary container **210** is ready to receive a charge of food from conveyor system **208**, which in the illustrated embodiment the food is French fries FF

[0186] An alternative embodiment for secondary container **210** is illustrated in **FIG. 4A** Secondary container **210'** is composed of a pair of opposed spaced apart sidewalls **211** (only one sidewall **211** is illustrated and is depicted in a half-moon configuration) and a pair of sidewalls **213*a*** and **213*b***, oriented in a V-shaped relationship when container **210'** is configured to receive food from conveyor body **214** Sidewall **213*a*** is mounted for pivotal movement about apex **215** of sidewalls **213*a*** and **213*b***. Such movement is accomplished by a drive mechanism similar to cylinder **264**, drive gear **268** and driven gear **270**, which in this embodiment are cylinder **264'**, drive gear **268'** and driven gear **270'**, which gear **270'** is attached to sidewall **213*a*** When cylinder **264'** is extended, sidewall **213*a*** is caused to pivot downwardly as indicated by arrow AA to the position of sidewall **213*a***

shown in phantom, thereby causing the contents (French fries FF) of container **210'** to be dumped. Sidewalls **211** act as sidewall guides for sidewalls **213***a* and **213***b* when sidewall **213***a* is in a lowered position, in which case sidewalls **213***a* and **213***b* act as a chute or slide.

[0187] Control system **262** coordinates the operation of the various functions of food dispensing device **200**. For example, when food dispensing device **200** is ready to dump a charge of food from secondary container **210** out of food dispensing device **200**, control system **262** activates cylinder **222** to open discharge door **220** thereby permitting the food charge in secondary container **210** to be dumped by dumping mechanism **218** through open discharge door **220**. After dumping of the food charge is completed, control system **114** causes dump cylinder **264** to be retracted thereby returning secondary container **210** to a position ready to accept a further charge of food from conveyor system **208**. Cylinder **222** has one end rigidly secured to cabinet **202** or some other suitable location and the other end of cylinder **222** is attached to discharge door **220**. Typically, discharge door **220** will have a suitable guide mechanism, which may be tracks, slots or other suitable apparatus to guide discharge door **220** to its open and closed positions. Cylinder **222** is operable to move door **220** up and down as indicated by arrow B in **FIG. 6** to thereby open and close discharge door **220** as desired. In the illustrated embodiment, discharge door **220** extends across all four dispensing lanes **226, 228, 230** and **232**. If desired, a separate discharge door could be provided for each of dispensing lanes **226, 228, 230** and **232**. In addition, control system **262** causes activation of cylinder **222** to close discharge door **220** to prevent heat from entering into cavity **272** of food dispensing device **200** in which the food and various dispensing mechanisms are contained as illustrated in **FIGS. 3 and 6**, for example.

[0188] Food dispensing device **200** can contain suitable refrigeration components **274** such as within a lower portion of cabinet **202** as shown schematically in **FIG. 1**. In accordance with the preferred embodiment of food dispensing device **200**, refrigeration components **274** provide sufficient cooling to provide a below freezing temperature environment in cavity **272**. Alternatively, suitable refrigeration components can be provided exteriorly of cabinet **202** and even at a remote location as desired. In addition, a storage compartment **276** and a storage compartment door **278** may also be provided in cabinet **202**. An upper side access-door may also be provided to permit operator access to the interior of cavity **272** where uncooked bulk food dispensing containers **204** and/or magazine food dispensers **206** and/or **209, 211** and **213** are located.

[0189] Referring to **FIGS. 2 and 7-10**, there is illustrated another embodiment of food dispensing device **201** in accordance with the present invention.

[0190] Food dispensing device **201** has many similarities to food dispensing device **200** previously described where like reference numerals represent like elements. Thus, food dispensing device **201** includes cabinet **202**, four product dispensing lanes **226, 228, 230** and **232** with each such lane incorporating conveyor system **208**, secondary container **210**, vibratory mechanism **212**, conveyor body **214**, weighing mechanism **216**, dumping mechanism **218**, discharge door **220**, cylinder **222**, insulating material **224**, food handling system **242**, upper opening **244**, rear door **246**, uncooked bulk food dispensing container **204** which is associated with product dispensing lane **234**, a dump cylinder **264** for each product dispensing lane, cavity **272**, refrigeration components **274**, storage compartment **276** and a storage compartment door **278**. Product dispensing lanes **228, 230** and **232** each have associated therewith a plurality of magazine food dispensers **280-308** arrayed to provide in the embodiment illustrated in **FIG. 9** five magazine food dispensers per product dispensing lane in which there are three product dispensing lanes serviced by the foregoing magazine food dispensers. Consequently, magazine food dispensers are configured in a three-by-five array and are suspended from a magazine food dispenser support **310** as shown in **FIG. 9**. Each row of three magazine food dispensers depends from magazine food dispenser support **310** via a slide assembly **312**. Slide assembly **312** is similar to a drawer slide including a pair of first and second elongated telescoping left and right slides **314** and **316**, respectively. Suitable upper rollers **318** are mounted to magazine food dispenser support **310** and lower rollers **320** depend from magazine food dispensers **280-308** for traversing left and right elongated telescoping slides **314** and **316**.

[0191] Suitable mounting brackets **322** are provided which depend upwardly from magazine food dispenser support **310** for mounting to cabinet **202**.

[0192] In addition, suitable mounting brackets **324** are provided which depend downwardly from magazine food dispenser support **310** for mounting slide assembly **312** thereto allowing magazine food dispensers **280-308** to depend therefrom.

[0193] Magazine food dispenser support **310** has a series of holes **326** and **328** therein. Holes **326** can be provided to allow increased airflow and cooling. Holes **328** can also be provided to provide increased airflow and cooling for magazine food dispensers **280-308**.

[0194] Each of magazine food dispensers **280-308** and **206, 209, 211** and **213** briefly discussed with respect to food dispensing device **200** are similar in construction. Magazine food dispenser **206** will be discussed with respect to **FIGS. 7 and 8** and it is to be understood that the other magazine food dispensers are of similar construction.

[0195] Magazine food dispenser **206** includes a body or housing **330** that includes sidewalls **332** and **334**, front walls **336** and **338** and corresponding rear walls (not shown) and can be attached in a removable manner if desired, including in a snap-on arrangement to facilitate cleaning. Magazine food dispenser **206** also includes a top member or cover **340** having mounted thereover a drive mechanism **342**. Drive mechanism **342** includes a drive gear or wheel **344** and a driven wheel or gear **346**. Depending from each of drive wheel or gear **344** and driven wheel or gear **346** is a spiral flight that is vertically or generally vertically oriented relative to the longitudinal axis of spiral flights **348** and **350**. If desired, a single spiral flight dispenser (not shown) could also be utilized.

[0196] Body **330** of magazine food dispenser **206** can include substantial open portions such as front open portion **352** and a corresponding rear open portion (not shown). Such open portions may have a cover or access door thereover (not shown). Such open portions can be desirable to permit airflow through magazine food dispenser **206** since

generally such dispenser will be contained in a refrigerated environment and such openings help ensure that food contained therein remains frozen or chilled as desired A vertical divider (not shown) can be provided between spiral flights **348** and **350** if desired

[**0197**] A plurality of generally vertically disposed and spaced apart rods **354, 356** and **358** may be provided at the front of magazine food dispenser **206** adjacent spiral flights **348** and **350** and similar rods can be provided at the back of magazine food dispenser **206** Rods **354, 356** and **358** prevent food pieces from falling out of spiral flights **348** and **350** and to maintain spiral flights **348** and **350** in a vertical orientation

[**0198**] Magazine food dispenser **206** has an open bottom **360** through which food pieces can be dispensed during operation

[**0199**] During operation, drive wheel **344** can be driven by a suitable electric motor, such as an electric motor **362, 364** and **366** shown with respect to magazine food dispensers **280, 282** and **284** in **FIG. 9** Alternatively, other drive devices could be used, including, for example, a rotary air or hydraulic cylinder Rotation of drive wheel **344** in a clockwise direction causes driven wheel **346** to rotate in a counterclockwise direction by virtue of the intermeshing or contact between drive wheel or gear **344** and driven wheel or gear **346** Such rotation causes corresponding rotation of spiral flights **348** and **350**, respectively Food contained by spiral flights **348** and/or **350** is moved downwardly by virtue of such rotation When such food reaches the bottom of spiral flights **348** and/or **350**, respectively, such food is discharged from magazine food dispenser **206** through open bottom **360** and onto conveyor system **208** for handling as previously described A single motor could be used to drive a plurality of dispensers **280, 282** and **284**, etc through a suitable drive mechanism (not shown)

[**0200**] As shown in **FIG. 8**, pieces of food can be contained by magazine food dispenser **206** in two different ways For example, individual pieces of food may each be contained by a single elongated spiral flight **348** or **350** as shown with respect to food pieces F1 and F2, respectively. Food pieces F1 and F2 can be any type of desired food and may be a food item such as a hash brown, an individual portion pie, rectangular food patty, or other type of food as desired Chicken nuggets and other food can also be dispensed with the bulk dispenser previously described Larger items of food can span across portions of both elongated spiral flights **348** and **350** as illustrated with respect to food item F3, which may be a larger food item, such as a chicken patty, or other type of food article as desired Spiral flights **348** and **350** can be of a desired radial diameter so that the food piece or pieces that are to be contained and dispensed in magazine food dispenser **206** can be accommodated as illustrated in **FIG. 8** Each spiral can contain a food piece so that as illustrated in **FIG. 7**, the illustrated spirals of spiral flights **348** and **350** could each accommodate twelve food pieces such as food pieces F1 or F2 for a total of twenty-four food pieces or twelve food pieces such as food piece F3 of **FIG. 8** As will be appreciated, spiral flights having a greater or lesser number of flights can be used if desired to hold a greater or lesser number of food pieces, respectively

[**0201**] A suitable home position sensor **362'** can be utilized to indicate a home or start position of each of spiral flights **348** and **350** As illustrated in **FIG. 7**, a pair of position indicating sensors **362'** and **364'** are utilized and mounted on drive wheel **344** 180° apart for more precise locating of the position of spiral flights **348** and **350**. Sensors **362'** and **364'** can be proximity sensors that align with corresponding sensor pickups on the respective drive gear or motor for magazine food dispenser **206** (not shown)

[**0202**] Preferably, spiral flights **348** and **350** are offset by one rotation so that a single food item such as food item F1 or F2 in **FIG. 8** will be dispensed from one of either spiral flight **348** or **350** for each one-half rotation of spiral flights **348** and **350**

[**0203**] Preferably, food dispensing device **200** and food dispensing device **201** are constructed in modular form, an example of which is illustrated in **FIGS. 1 and 2**, respectively Wheels **368** are provided to permit cabinets **202, 402** and **602** to be suitably transported across a relatively flat surface, such as a restaurant work area floor

[**0204**] Food Frying Device

[**0205**] Referring to the Figures generally, and in particular to **FIGS. 1-2** and **11-24**, there is illustrated fry device **400** and various components and alternative components thereof in accordance with the invention

[**0206**] In one embodiment, fry device **400** includes cabinet **402**, four fry wheels **404, 410, 412** and **414**, four fry vats **406, 416, 418** and **420**, four drive mechanisms **408**, one for each of fry wheels **404, 410, 412** and **414** Each fry vat **406, 416, 418** and **420** is dimensioned to contain a desired volume of a suitable cooking oil Each fry vat **406, 416, 418** and **420** is dedicated to one of fry wheels **404, 410, 412** and **414**, respectively

[**0207**] In operation in the preferred embodiment, fry device **400** is positioned to receive the food dispensed from a food dispensing device, such as food dispensing device **200** and food dispensing device **201** Consequently, it is advantageous to position fry device **400** adjacent food dispensing device **200** or **201** as illustrated in **FIGS. 1 and 2**, respectively A suitable control panel **456** can be provided and located in a suitable location, such as on the side of cabinet **402** In the illustrated embodiment, control panel **456** contains a separate display for each of fry wheels **404, 410, 412** and **414** referred to by reference numerals **456***a-d*, respectively Control panels and displays **456***a-d* can include information such as set cycle time, oil temperature, oil level as well as controls to adjust cycle time and oil temperature, for example

[**0208**] Referring to **FIG. 13**, there is illustrated fry wheel **410** Fry wheel **410** includes two opposed circular spaced apart circular disks **458***a* and **458***b*. Disks **458***a* and **458***b* can include a plurality of apertures **460** as desired to reduce wheel weight and to provide circulation of cooking oil and to permit passage of water vapor therethrough, such as during frying food products, for example. A fry wheel axle **462** is provided to which disks **458***a* and **458***b* are mounted Axle **462** is suitably mounted, typically and preferably for rotation with respect to fry vat **406** at a location above the normal level of cooking oil or range of levels of cooking oil that will be encountered in fry vat **406** during operation

[**0209**] In one embodiment, outer peripheral edge **464** of each of disks **458***a* and **458***b* include a plurality of teeth **466**

[0210] Teeth **466** can be utilized to drive fry wheel **410** in a manner as hereinafter described. Referring to **FIGS. 14-16**, there is illustrated in sectional view of disk **458***a* of fry wheel **410**, a portion of which is located within fry vat **406**. A drive wheel **468** is associated in operative position relative to teeth **466** located on outer peripheral edge **464** of disk **458***a*. Drive wheel **468** can be formed from a disk of material of a suitable thickness having a circumferential groove **470** therein. Circumferential groove **470** is typically at least or slightly greater than the thickness of disk **458***a* in the area where drive wheel **468** and disk **458***a* are juxtaposed as illustrated in **FIGS. 14 and 15**. A series of spaced apart pins **472** extend across circumferential groove **470** and are radially arrayed and spaced from the center of drive wheel **468**. Drive wheel **468** includes a central aperture **474** through which a drive axle **476** can be mounted. In operation, drive wheel **468** is rotated by drive axle **476** with drive wheel **468** being positioned a fixed distance from disk **458***a* so that pins **472** mesh with teeth **466** when rotated as illustrated in **FIG. 14** thereby causing rotation of disk **458***a* and consequently fry wheel **410** in a direction of rotation opposite to the rotation of drive wheel **468**, as indicated by arrows K and L of **FIG. 14**.

[0211] It is to be understood that any suitable drive wheel and drive arrangement can be utilized. For example, in place of drive wheel **468** with pins **472**, a drive arrangement could be utilized in which a drive gear is utilized to mesh with a corresponding gear located around the periphery of disk **458***a* and/or **458***b*, for example. Alternatively, a friction drive system could be utilized in which a friction drive wheel would contact the edge of one or both of circular disks **458** which could be of a design having no teeth therealong, such as illustrated in alternative embodiment wheels **479** and **481** described hereafter. Since the wheel will have cooking oil thereon, the coefficient of friction between the drive wheel and fry wheel will be decreased. Care should be taken to assure that when using a friction drive, sufficient pressure is maintained between the driving wheel and the fry wheel.

[0212] Referring to **FIG. 16**, there is illustrated a drive mechanism for driving drive wheel **468**. The drive mechanism includes an electric motor **478**, a gear reduction drive **480**, an output shaft **482**, a drive pulley wheel **484**, a driven pulley wheel **486** and a drive belt **488** extending around drive pulley wheel **484** and driven pulley wheel **486** to drive axle **476** which thereby drives drive wheel **468** since the end **476***a* of axle **476** is fixed in aperture **474** with respect to drive wheel **468**. A shear pin **490** can be located in a shear pin aperture **492** of drive wheel **468** to retain axle **476** in a fixed position relative to drive wheel **468**. Axle **476** is suitably contained within an axle journal **494** which, in turn, is mounted to frame **496** to permit movement of axle **476** relative to axle journal **494** and frame **496**. Similarly, motor **478** and gear reduction drive **480** are suitably mounted to frame **496**. If desired, motor **478** may be a stepper motor.

[0213] Typically, it is important that the fry wheel is rotated in periodic increments for a compartment to be aligned with a respective discharge slide **498** of fry device **400** or other slide, ramp or discharge location after a periodic rotation. Typically, the leading edge **500** of a compartment bottom, such as compartment bottom **432'** of compartment **432** as shown in **FIG. 13** is aligned with the upper edge of fry vat **406** or the top edge of discharge chute **498** associated therewith to allow the contents of compartment **432** to be discharged therefrom. As illustrated in **FIG. 13**, the contents of compartment **432** have already been discharged from fry wheel **410**. This is particularly important where incremental rotation of fry wheel **410** is utilized as opposed to a continuously moving fry wheel. Thus, for incremental rotation it is desirable for bottom edge **500** of compartment **432** to be aligned with discharge **498** or the upper edge **406'** of fry vat **406**. In order to accomplish this, a stepper motor can be utilized to drive fry wheel **410**. Alternatively, or in addition, the position of the baskets can be sensed and their position adjusted accordingly to assure that all baskets are in the correct position for loading and discharge during operation. Also, utilizing location sensors allows use of a simple DC or AC motor, as opposed to a stepper or servo motor. Any suitable sensor can be utilized in conjunction with a control system to control operation of the fry wheel drive motor. Suitable sensors include proximity, magnetic reed, Hall Effect, photoelectric and capacitive sensors. Such sensors are well known in the art and consequently a detailed description of those sensors is not included herein.

[0214] In accordance with another aspect of the invention, it should be understood that the height of cooking oil in one of fry vats **406**, **416**, **418** and **420**, such as the level of cooking oil indicated by reference letter H in **FIG. 13** in fry vat **406** will increase or decrease depending upon the amount of food that is submerged underneath the surface of cooking oil contained in fry vat **406**. Thus, as illustrated in **FIG. 13**, compartments **424**, **426**, **428** and **430** each have a charge of food, in this case French fries **455** contained therein. Each compartment contains approximately one pound of French fries **455**. Consequently, there are about four pounds of French fries that are beneath the surface level H of cooking oil contained in fry vat **406**. This quantity of submerged food raises the level H of cooking oil in fry vat **406**. This increase in the level of cooking oil can cause the food to be submerged and therefore cooked for a longer of period of time in the cooking oil. For example, contrast the level of cooking oil depicted in **FIG. 13** with the level of cooking oil depicted in **FIG. 20** in which a charge of French fries **455** is contained only within compartment **426**. This results in a substantially reduced level of cooking oil H' as indicated in **FIG. 20**. Thus, the control system for fry device **400** can be adjusted to take into account for different levels of cooking oil which can be sensed by a suitable sensor as is known by those skilled in the art (not shown). Where rotation of fry wheel **410** is done incrementally after a period of time elapses, the period between incremental rotations can be increased or decreased as desired based on the level of cooking oil present in fry vat **406**. For example, in the situation illustrated in **FIG. 13**, the duration between incremental rotation of fry wheel **410** could be decreased compared to the situation depicted in **FIG. 20** where the level H' of cooking oil is significantly lower than the level H of cooking oil in **FIG. 13**. This assumes that the temperature of cooking oil in each of the situations depicted in **FIGS. 13 and 20** is substantially the same. Similarly, if a constant rotation fry wheel operation is utilized, such as where fry wheel **410** would rotate constantly, the rotational speed could be increased to handle the situation depicted in **FIG. 13** compared to the speed of the wheel that would be utilized for the situation in **FIG. 20**, where the level H' of cooking oil in **FIG. 20** is significantly less than the level H of cooking oil in **FIG. 13**.

[0215] Referring to **FIGS. 13 and 20**, frying device **400** can also include a fry wheel follower "or fry wheel liner"**502** which is supported by a fry wheel follower support **504**. Fry wheel follower **502** is a curved perforated circular segment having a width approximately equal to the width of fry wheel **410**. Fry wheel follower **502** is supported by a pair of fry wheel follower supports **504** that are spaced apart and connected by lateral supports **506**. Fry wheel follower **502** prevents food pieces that are larger than the perforations in fry wheel follower **502** from falling from fry wheel compartments **422-436** during operation. Preferably, the perforations in fry wheel follower **502** are composed of circular holes having a diameter of about 0.187 inches that are in staggered rows having a center-to-center hole distance of about 0.312 inches. Fry vat **406** includes a suitable heating element **505**, illustrated in **FIGS. 13, 20** and **21**.

[0216] Referring to **FIGS. 17-19** there is illustrated a curved compartment forming member **438** which is composed of two opposed sidewalls **508***a* and **508***b* that are interconnected by a curved J-shaped member **510** that forms compartment bottom **510***a* and compartment top **510***b*. Preferably, a wiper **512** is suitably mounted to compartment member **510**.

[0217] A plurality of compartment forming members **438** are mounted together in fry wheel **410** to provide a plurality of adjacent peripheral food compartments **422-436** as illustrated in **FIG. 13**. As illustrated in **FIG. 13**, the top of one J-shaped member **510** abuts the bottom of adjacent J-shaped member **510**. Thus, advantageously, a fastening member **514**, which can be a rivet, for example, that secures wiper **512** to compartment bottom **510***a* of one curved J-shaped member **510** will also pass through the compartment top **510***b* of the adjacent curved J-shaped member **510**. Preferably, wiper **512** has a plurality of transversely extending grooves **516***a-f* that permit drainage of cooking oil therethrough as wiper **512** exits the cooking oil in fry vat **406**, for example.

[0218] Referring to **FIG. 17**, opposed sidewalls **508***a,b* and curved J-shaped member **510** are perforated to permit the flow of cooking oil therethrough thereby promoting good heat transfer between the cooking oil contained in fry vat **406** and food contained in one of compartments **422-436** when immersed in cooking oil. A suitable hole size is about 0.156 inches spaced center-to-center about 0.250 inches. Wiper **512** also ensures that close contact is maintained between the interface of fry wheel follower **502** and the top and bottom ends of each food compartment **422-436** which in each case will be bounded by one of wipers **512**. Any suitable material can be used for wiper **512** such as rubber or Teflon, for example.

[0219] As an alternative construction, compartments **422-436** could be constructed from curved J-shaped members **510** without opposed sidewalls **508***a* and **508***b*, in which case the compartment sidewalls could be formed from opposed circular disks **458***a* and **458***b*. In addition, it should be appreciated by one skilled in the art that any desired compartment shape can be utilized in accordance with the invention as long as the food can be loaded into the compartment, kept within the compartment during immersion in the cooking oil and which compartment shape discharges the food from the fry wheel.

[0220] Referring to **FIGS. 21 and 22**, there are illustrated further aspects of fry device **400**. **FIG. 21** is a sectional view along line **21-21** of **FIG. 20**. **FIG. 21** illustrates the elements previously described and in addition shows the interface of adjacent fry vats **406** and **420** and in enlarged form in **FIG. 22**. Disposed between fry vats **406** and **420** is a banking strip **518** that bridges the gap between fry vats **406** and **420**. Banking strip **518** can be in a shape as desired and in the illustrated embodiment is a generally inverted V-shaped strip that spans the gap between fry vats **406** and **420**. Banking strip **518** prevents any material that is discharged between fry wheels **410** and **412** from falling between fry vats **406** and **420** and causing such material to fall into one of fry vats **406** and **420**.

[0221] Referring to **FIGS. 23 and 24**, there are illustrated alternate embodiments of a fry wheel for use in accordance with the invention. It is to be understood that the fry wheel is capable of numerous changes and rearrangements, and the fry wheel, as well as other components and embodiments of the present invention, is not intended to be limited to the specific embodiments described herein.

[0222] Referring to **FIGS. 23 and 24**, there are illustrated wire form wheels **479** and **481**. Each of wheels **479** and **481** has a rim **520** and **522**, respectively, constructed of tubing, which can be smooth tubing. Such a wheel could be driven by a friction wheel, if desired. In each of wheels **479** and **481** a plurality of individual tubular spokes **524** extend from each rim to a corresponding hub assembly **526**. An axle **528** connects hubs **526** together in each of wheels **479** and **481**. Wheel **479** includes a slotted member **530** that bridges each pair of spokes **524**. Each slotted member **530** includes a centrally disposed slot **532** and a pair of tabs **534** on either side of slot **532**. A plurality of fry baskets **536**, one for each slotted member **530** or pair of spokes **524** is mounted in a snap-lock relationship to each slotted member **530**. Fry baskets **536** have perforated sides and a perforated bottom and top and can be of a similar configuration as previously described with respect to fry wheel **410**. Each basket **536** can have a spring tab member **538** that interlocks with slotted member **530** to secure fry basket **536** to fry wheel **479** resulting in a finished fry wheel **481** as shown in **FIG. 24**. It is to be understood that the embodiment illustrated in **FIGS. 23 and 24** is not limited to snap-in baskets and that other baskets can be used with the wheel arrangement depicted in **FIG. 23** with or without slotted members **530**. For example, baskets could be welded or otherwise affixed to rim **520** and spokes **524**. Each of fry baskets **536** includes perforations **540** on the sides, top and bottom thereof, such as previously described with respect to compartment forming member **438**.

[0223] Referring to **FIG. 24**, there is illustrated an alternative drive mechanism **535** to rotate fry wheel **481**. Drive mechanism **535** includes a motor **537**, a shaft **539** and drive rollers **541** and structure for supplying a force in the direction of arrow FW. Drive rollers **541** are mounted on shaft **539** which can be rotated by motor **537** to cause rollers **541**, each aligned with one of rims **522**, to rotate, thereby rotating fry wheel **481**. A force FW is supplied in the direction of arrow FW to ensure that rollers **541** impart a sufficient tractive force to cause rotation of fry wheel **481**. Force FW can be supplied by any suitable structure, including a spring, a weight or an electromagnet, for example. For example, motor **537**, shaft **539** and rollers **541** could be mounted on a platform (not shown) that is moveable in the direction of arrow FW and a force could be applied to urge platform in

the direction of arrow FW to ensure proper traction of rollers **541**. Rollers **541** may be constructed of any suitable material, including rubber, for example. Motor **537** can be controlled by fry control **116**, for example.

[0224] Fry wheel **410** can be rotated as desired so that food deposited in one of compartments **422-436** travels through and out of the cooking oil **454** until that compartment reaches a discharge location. Thus, in the embodiment illustrated in **FIGS. 13 and 20**, the rotation is in a clockwise direction as indicated by arrow K in **FIG. 13** and arrow K in **FIG. 20**. The rotation of fry wheel **410** can be either continuous or periodic. In a periodic rotation, the rotation will typically be incremental, that is, the wheel is rotated to some degree and then stops. Thereafter, after a set period of time, the wheel undergoes another periodic rotation. This process continues as each fry basket is rotated through and out of the cooking oil vat and to the discharge location. Preferably, each periodic rotation consists of a rotation of 360° divided by the number of compartments present in the fry wheel or some fraction of that periodic rotation increment so that the position of the wheel can be known without the use of sensors. However, the use of a sensor or sensors to be able to monitor wheel position can also be used either as the primary way of controlling wheel position or as a backup. Also, use of a sensor to determine wheel position allows use of a standard AC or DC motor. Suitable control of wheel **410** can be accomplished by fry control **116**, for example.

[0225] In accordance with the present invention, a basket shaking simulation can be achieved. Basket shaking simulation can be performed by a relatively slight back and forth rotation of the fry wheel, such as fry wheel **410**. Thus, the drive mechanism is activated to rotate the fry wheel clockwise and counterclockwise through a relatively small degree of angular rotation to simulate shaking of a fry basket during frying. The back and forth rotation can occur relatively rapidly and typically the degree of angular rotation will be in the range of from about 2 to about 20 degrees. In addition, the periodic rotation in one direction may be of a larger angle of rotation than the rotation in the other direction.

[0226] Preferably, the degree of rotation during simulated basket shaking will be monitored, particularly where the rotation in one direction is greater than the rotation in the other direction so that the position of each basket relative to the discharge location can be monitored by the control system to ensure proper discharge of food from food compartments.

[0227] Referring to **FIG. 64**, there is illustrated in partially schematic view fry device **400** along with portions of food dispensing device **200** and food packaging device **600**. As illustrated in **FIG. 64** a hood system **546** is provided. Hood system **538** includes a hood structure **548**, a filter **542** and a drip pan **544**.

[0228] A suitable air blower (not shown) can be provided to cause air flow to move within hood system **538** generally in the direction of arrows A1, A2 and A3. Filter **542** thus filters particulate matter in air flow A1 that passes through filter **542**. Drip pan **544** catches any matter that drips from filter **542** that is located above drip pan **544**. Preferably, hood system **538** substantially completely encloses the area above fry device **400** to reduce waste discharge into the operating environment of automated food processing system **100**.

[0229] Food Packaging Device

[0230] Referring to the Figures generally, and in particular to **FIGS. 1 and 25-50**, there is illustrated various embodiments of food packaging devices and elements thereof in accordance with the invention.

[0231] In one embodiment, food packaging device **600** is illustrated or partially illustrated and elements useful in connection with food packaging device **600** are illustrated in **FIGS. 1 and 25-50**. Food packaging device **600** includes a cabinet **602** having a countertop surface **636**. Food packaging device **600** can be advantageously constructed in modular form so that it can be operated together with previously described food dispensing device **200** and fry device **400** and alternatively operated separately from both or either of those devices.

[0232] Food packaging device **600** in the illustrated embodiment includes a food inlet chute **604**, rotatable food dispensing member **606**, food dispensing chute mechanism **608**, automated container handling system **610**, container-receiving receptacle **612**, overflow food collection member **613**, conveyor system **614**, waste chute **615**, food seasoning system **616** and raceway **620**.

[0233] In the illustrated embodiment, food packaging device **600** includes a container storage device for containing cartons or containers of various sizes. During operation of packaging device **600**, the device selects a container of a desired size from container storage magazine **638**, erects the container into an erected form that is unerected while contained in storage magazine **638** and then positions the erected container to receive food dispensed from food dispensing chute mechanism **608**. After receiving food from food dispensing chute mechanism **608**, automated container handling device **610** is capable of moving the filled or partially filled container to container receiving receptacle **612** which is transported via conveyor system **614** to a desired location for subsequent pickup of the container by a human operator, for example.

[0234] In the embodiment illustrated in **FIGS. 25-29**, food packaging device **600** includes food overflow collection member **613** to collect food dispensed by food dispensing chute mechanism **608** that is not deposited into a container. In the illustrated embodiment, overflow food collection device **613** is a rotatable wheel as hereinafter described in detail. Overflow food collection member **613** functions to collect food dispensed by food dispensing chute mechanism **608** that is not received in a container and to recycle that food into food dispensing chute mechanism **608** for subsequent dispensing to a container. This permits food dispensed by food dispensing chute mechanism **608** but not deposited in a container to be promptly recycled to the dispensing chute in a first-in, first-out manner, so that overflow food is promptly recycled and dispensed to a container.

[0235] Referring to **FIGS. 26-28**, there is illustrated food packaging device **600** in which inlet chute **604** is positioned to receive food, in this case French fries, from food dispensing lanes **234**, **236** and **238** of dispensing device **200**, which food has been subsequently fried after dispensing in fry wheels **410**, **412** and **414** of fry device **400**. After frying in any of wheels **410**, **412** and **414** of fry device **400**, food dispensed therefrom enters inlet chute **604**, as illustrated in **FIGS. 3 and 28**, for example. In inlet chute **604** the food

travels downwardly along chute **604** and into rotatable food dispensing member **606** in the direction of arrow M of **FIG. 28** and arrow E of **FIG. 3**. Inlet chute **604** can be configured as desired and may be configured to accept the product from any one or all of fry wheels **404, 410, 412** and **414**. In **FIGS. 25-27**, a holding area **607** receives product from fry wheel **404** for manual packaging. A manual or automated diverter bar **605** can optionally be provided as shown in **FIG. 27** to divert French fries from device **600** to permit filling unsalted fry orders. Bar **605** can be moved between open and closed positions as indicated by arrow Z, such as by a cylinder (not shown).

[0236] Rotatable food dispensing member **606** in the illustrated embodiment is a dispensing wheel that is mounted for rotation in dispensing device **600**. Dispensing member **606** has a plurality of food containing compartments **640** that are arrayed around the periphery of rotatable food dispensing member **606**. Each of compartments **640** is divided from another compartment by a compartment wall **642**. Preferably, each compartment wall **642** is not normal to peripheral edge **644** of rotatable food dispensing member **606** but at a slight angle such as, for example, as illustrated in **FIG. 29** and **FIG. 61**.

[0237] Wheel **606** includes a pair of opposed rim portions **646***a* and **646***b* and a circular ring portion **648** that interconnects opposed rims **646***a* and **646***b*. Circular ring **648** is disposed close to the peripheral edges of rims **646***a* and **646***b* and defines peripheral edge **644**. Preferably, circular ring **648** is constructed of a perforated metal material so that circular rims **646***a* and **646***b* have perforations **650** therethrough as illustrated in **FIG. 28**, for example.

[0238] In accordance with the illustrated embodiment, rotatable dispensing member **606** is configured as a rotatable wheel although other embodiments are within the scope of the invention. For example, a rotatable dispensing member in accordance with the invention could be a portion of a wheel, such as a semicircular or other configuration.

[0239] In the illustrated embodiment, rotatable food dispensing member **606** is rotated by a drive mechanism **652**. Drive mechanism **652** consists of a motor **654** that drives a drive wheel **656**. Drive mechanism **652** is controlled by a suitable control mechanism to cause rotation of drive wheel **656** and hence rotatable food dispensing member **606** in a desired direction and at a desired rate of speed. Drive wheel **656** can be a pressure roller or alternatively can be a drive wheel like or similar to drive wheel **468** previously described with respect to **FIG. 14**. Rotatable food dispensing member **606** can be driven via one or both of opposed rims **646***a* and **646***b*. Alternatively, and as illustrated in **FIG. 28**, rotatable food dispensing member **606** is driven through a drive rim **658**. Each of rotatable food dispensing members **606** and overflow food collection member **613** rest on spaced apart rollers **660** and **662**. Each of rollers **660** and **662** are constructed to bear the weight of rotatable food dispensing member **606** and overflow food collection member **613** and have a length that spans both. Alternatively, separate rollers or some other supporting structure could be used to support rotatable food dispensing member **606** and overflow food collection member **613**. An inner curved fender or baffle member **664** as illustrated in **FIG. 29** is provided to ensure that food contained in compartment **640** of rotatable food dispensing member **606** does not prematurely discharge. Preferably, fender **664** follows the inner curvature of rotatable food dispensing member **606** and has perforations **666**, which can be similar to perforations **650** of circular ring **648**. Fender **664** is suitably mounted so-that it is stationary relative to rotatable food dispensing member **606**. A similar fender could also be provided for overflow food collection member **613**, if desired (not shown).

[0240] Referring to **FIG. 61**, there is illustrated an elevation view of a portion of rotatable food dispensing member **606** which is typically rotated in the direction of arrow Y when viewed from the front of food packaging device **600**. Fender **664** prevents food, in this case French fries FF, from falling from compartments **640** prematurely.

[0241] Overflow food collection member **613** is configured to collect food deposited from food dispensing chute mechanism **608** that is intended to be received into container **611** when held in position to receive food from food dispensing chute mechanism **608** which food does not stay in container **611**. This can occur since oftentimes it is desirable to overfill container **611** so that food is mounded up above the top surface of container **611**. Also, for food such as French fries, such food material fills container **611** somewhat randomly and it is typical for French fries to dangle over the sides of container **611**. In the illustrated embodiment, overflow food collection member **613** is configured in a manner similar to rotatable food dispensing member **606** previously described. Thus, food collection member **613** includes opposed rims **668***a* and **668***b* and circular ring **670** having perforations **672**. Circular ring **670** connects opposed rims **668***a* and **668***b* in a manner as previously-described with respect to member **606**. In addition, food collection member **613** has a plurality of inner compartments that are similar in construction to compartment **640** previously described with respect to member **606**. Member **613** also has a drive rim **674** and is driven by a drive mechanism **676** that is similar to drive mechanism **652** previously described including a drive wheel **676'** and a motor **678**. Drive mechanism **676** is configured to rotate food collection member **613** in either a clockwise or counterclockwise direction as hereinafter described in more detail.

[0242] Food collection member **613** also includes a plurality of compartment walls **680** that are similar to compartment walls **642** previously described with respect to rotatable food dispensing member **606**, providing a plurality of food containing compartments **682**.

[0243] Each of food dispensing member **606** and food collection member **613** has bottom portions that are disposed through an opening **684** in countertop surface **636** of cabinet **602**. The construction of the illustrated embodiment permits food dispensing member **606** and overflow food collection member **613** to be readily removed from food packaging device **600** such as for cleaning and/or repair.

[0244] A heating system as described can be incorporated into food packaging device **600** to supply heat to food contained therein. For example, a heating system **681** can be provided, which is illustrated in **FIG. 29**. Heating system **681** includes a heating device **683** having a heating element **685**, located above dispenser **606** as desired. Heating devices **687** and **689** may also be included within dispenser **606** and/or **613** as desired. The heating devices may comprise radiant heaters and can be ceramic heaters, for example. Any suitable type of heating device or system can

be used in accordance with the invention Heating system **681** can be controlled by packaging control **118**, for example In addition, a heating device can be provided to direct heat to food container pick up location **622**, if desired to keep food contained thereat warm

[0245] Referring to **FIGS. 1, 3, 25-26, 28-29** and **43-44**, various aspects of the configuration and operation of food dispensing chute mechanism **608** are illustrated and will be described Food dispensing chute mechanism **608** includes an upper chute **686**, a lower chute **688**, a chute support member **690**, a connecting link **692**, a stop member **694**, a rotatable link **696** connecting stop member **694** to chute support member **690**, a rotatable link **698** connecting upper chute **686** to support member **690**, a cylinder **700** for operating food dispensing chute mechanism **608**, a load cell **702** for weighing the contents of food contained in food dispensing chute mechanism **608** and a rotatable link **704** connecting cylinder rod **706** to upper chute **686**

[0246] Upper chute **686** preferably and as illustrated in the referenced figures, forms part of food dispensing chute mechanism **608**, and has an inlet location **708** for receiving food dispensed from rotatable food dispensing member **606** and a discharge location **710** for dispensing food contained in food dispensing chute mechanism **608** and into a container, such as container **611** as illustrated in **FIG. 43**, for example

[0247] Upper chute **686** of food dispensing chute mechanism **608** is positioned to receive pieces of food from a discharge location **712** of rotatable food dispensing member **606**. Upper chute **686** has a food holding area **714** for holding food received from rotatable food dispensing member **606** A weighing device is associated with food dispensing chute mechanism **608** so that the amount of food contained therein, such as in food holding area **714**, can be determined Any suitable device can be utilized to determine the amount of food contained in food dispensing chute mechanism **608** In the illustrated embodiment, a load cell **702** is provided to determine the weight of food contained in food dispensing chute mechanism **608** and is illustrated schematically in **FIGS. 43 and 44**, for example

[0248] **FIG. 44** illustrates food dispensing chute mechanism **608** in the upper position ready to receive food from rotatable food dispensing member **606** In that configuration, cylinder **700** is retracted and upper chute **686** is generally horizontal This configuration allows a quantity of food to be dispensed into upper chute **686** and into food holding area **714** without being dispensed therefrom When a sufficient quantity of food is deposited in upper chute **686**, such as French fries FF, as determined by load cell **702** which communicates with the control system of food packaging device **600**, the food contained therein is ready to be dispensed Typically, the amount of food contained in chute **686** will be sufficient to adequately fill container **611** Since container **611** is of a known size, rotatable food dispensing member **606** can be operated to supply food to chute **686** until a desired quantity is contained therein for dispensing to container **611**

[0249] To dispense food from food dispensing chute mechanism **608**, cylinder **700** is activated to extend cylinder rod **706** upwardly thereby causing upper chute **686** to drop Since lower chute **688** is connected to upper chute **686** via connecting link **692**, lower chute **688** also drops to the discharge position as illustrated in **FIG. 43** which movement is indicated by arrow S Stop **694** which is connected to lower chute **688** and pivotally mounted via rotatable link **696** to chute support member **690**, engages chute support member **690** as illustrated in **FIG. 43** and prevents further downward movement of upper chute **686** and lower chute **688** In addition, stop member **694** engaging chute support member **690** defines the lowermost position of upper chute **686** and lower chute **688** which is also the dispensing position of food dispensing chute mechanism **608**, as illustrated in **FIG. 43** This position also provides discharge location **710** of dispensing chute mechanism **608**

[0250] Referring to **FIGS. 25-28**, there is illustrated container storage magazine **638**, which can form part of food packaging device **600** Container storage magazine **638** is configured to store a plurality of different sized food containers in an unerected form. Typically, container storage magazine **638** will be configured to hold a variety of different sized containers In the illustrated embodiment, container storage magazine **638** can contain four different sizes of French fry containers or cartons Container storage magazine **638** includes a base **716** that is suitably mounted with mounting structure **718** to cabinet **602** Preferably, mounting structure **718** permits container storage magazine **638** to be readily removed to permit access to rotatable food dispensing member **606** and overflow food collection member **613**

[0251] Base **716** typically can be in the form of a base plate and includes four apertures **720, 722, 724** and **726**, each of said apertures corresponding to the profile of a different size collapsed carton Apertures **720, 722, 724** and **726** are dimensioned to be able to retain a stack of cartons in a collapsed or unerected condition as illustrated in **FIG. 25** in which a plurality of unerected cartons **728** are stacked therein

[0252] Each aperture **720, 722, 724** and **726** and base **716** has associated therewith a plurality of guide members **730-760** In the illustrated embodiment, guides **730-760** are in the form of post or tubular-type members Each set of four guide members is associated with a specific one of apertures **720, 722, 724** and **726** to define and permit stacking of a plurality of unerected French fry cartons or containers that generally correspond in size to the size of apertures **720, 722, 724** and **726**, respectively It is to be understood that other arrangements to define a container stack can be utilized in accordance with the invention For example, in place of guides **730-760** other structure could be utilized, such as upstanding walls or partial walls or other types of guides

[0253] Container storage magazine **638** may also include a suitable removable cover (not shown) to enclose base **716** and the volume defined over apertures **720-726** by guides **730-760**

[0254] Container storage magazine **638** is preferably positioned to permit ready access to the bottom of each container stack through the bottom of each of apertures **720-726** by automated container handling system **610**, which is hereinafter described in detail

[0255] Food packaging device **600** includes automated container handling system **610** Automated container handling system **610** is capable of retrieving an unerected

container through any of apertures **720**, **722**, **724** and **726** of unerected container storage magazine **638**, erecting the unerected carton, holding the erected carton in position at discharge location **710** of food dispensing chute mechanism **608** and depositing the filled container onto conveyor system **614**, which conveyor system **614** subsequently transports the filled container to a desired location.

[0256] Referring to **FIGS. 1,25, 27-28** and **30-44**, there is illustrated automated container handling system **610** and elements and features thereof. Automated container handling system **610** includes a container retrieving and grasping device **762**, a container grasping device **764** and a container bottom urging device **766**.

[0257] Automated container handling system **610** is controlled by a suitable control system for food packaging device **600**.

[0258] Container retrieving and grasping device **762** and portions thereof are best illustrated in **FIGS. 30-39**. Container retrieving and grasping device **762** includes a mast **768**, which is mounted to a carriage system **770**, a moveable rack member **772**, a pinion **774**, a frame **776**, a container grasping member **778** and a linkage assembly **780**.

[0259] Mast **768** is carried by carriage system **770** which carriage system **770** allows for lateral translation of mast **768** and the components associated therewith, including moveable rack member **772**, pinion **774**, frame **776**, container grasping member **778** and linkage assembly **780**. Carriage system **770** includes a guide member **782**, a worm gear **784**, a drive mechanism **786** and a carriage follower **788**. Carriage follower **788** supports a vertical translation mechanism **790** that, in turn, carries mast **768**.

[0260] Carriage guide **782** is an elongated guide that defines the lateral translation movement direction of carriage follower **788** and is secured within cabinet **602**. Worm gear **784** is disposed parallel to carriage guide **782** and when rotated moves carriage follower **788** along carriage guide **782**.

[0261] Worm gear **784** is driven by drive mechanism **786** which can include a drive motor **792**, a drive gear or pulley **794** and a driven gear or pulley **796**. Where drive and driven pulleys are used, typically a belt **798** will impart rotation from one pulley to another.

[0262] Drive motor **792** causes worm gear **784** which is mounted for rotation and which is rotated by rotation of driven pulley or gear **796** in either direction. Drive motor **792** can be an AC or DC motor or a stepper or servo motor as desired. Suitable sensors can be employed (not shown) to determine the position of carriage follower **788** which determines the lateral position of container grasping member **778**.

[0263] Carriage follower **788** is composed of a frame **800** having a guide aperture or slot **802** in which carriage guide **782** is disposed and a threaded aperture or slot **804** in which elongated worm gear **784** is disposed to impart lateral motion to carriage follower **788** by rotation of worm gear **784**. Thus, carriage system **770** provides lateral movement in the direction of arrows Q as shown in **FIG. 39**. In this manner, carriage follower and thus mast **768** can be laterally translated as desired.

[0264] A suitable opening **806** is located in countertop surface **636** of cabinet **602** to permit mast **768** to extend therethrough.

[0265] Mast **768** can be raised and lowered in a vertical direction as indicated by arrow V in **FIG. 39**.

[0266] Mast **768** can be vertically raised and lowered in the directions indicated by arrow V in **FIG. 39** by operation of a drive mechanism **810** that forms part of vertical translation mechanism **790**. Vertical translation mechanism **790** is a vertically extending carriage system similar to that described with respect to carriage system **770** and includes a drive mechanism **810** which is composed of a motor **812** which is carried by carriage follower **788**, a vertically disposed carriage guide **814**, a vertically disposed worm gear **816** which is driven in a suitable manner by motor **812** such as previously described with respect to drive mechanism **786** of carriage system **770**, which can be controlled in a similar manner. Vertical translation mechanism **790** also includes a vertical carriage follower **818** having a threaded aperture or slot and a guide aperture or slot (not shown) which vertical carriage follower **818** is secured to mast **768**.

[0267] Mast **768** has mounted thereto frame **776**, typically at an upper end thereof. Linkage assembly **780** is secured to frame **776** as well as pinion **774** and moveable rack member **772**.

[0268] Moveable rack member **772** includes a frame **820** having a guide slot **822** vertically disposed therein and a rack **824** which meshes with pinion **774**. Moveable rack member **772** may also include extra mass in the form of a weight block **826** to help urge moveable rack member downwardly when not restrained.

[0269] A pair of guides **828** and **830** are rigidly secured to frame **776** and are disposed within slot **822** of moveable rack **772**. A spring **832** can be connected between an upper end of moveable rack member **772** and guide **828** or **830** to urge moveable rack member **772** to a lower position as illustrated in **FIG. 30** compared with the upper position as illustrated in **FIGS. 34-37**.

[0270] In a preferred embodiment, moveable rack member **772** includes a stop **834** which stop can be vertically adjustable. While stop **834** is located at the bottom of moveable rack member **772** it is to be understood that a stop could be provided at another location provided that a suitable engaging surface at a proper location is provided.

[0271] Mounted to frame **776** is an axle **836** that is mounted for rotation relative to frame **776**. Axle **836** has pinion gear **774** rigidly secured thereto as well as one end **838** of linkage **780**. The other end **840'** of linkage **780** is securely mounted to frame **776** as illustrated in **FIGS. 30-37**, for example.

[0272] Linkage **780** which carries container grasping member **778** is composed of a plurality of links so that container grasping member **778** is moveable from a horizontal position as illustrated in **FIGS. 30-32** to a vertical position as illustrated in **FIGS. 34-37**. When container grasping member **778** is in the horizontal position it is utilized to grasp and retrieve a desired size of container from one of the apertures **720**, **722**, **724** and **726** from container storage magazine **638**. For this purpose, container grasping member **778** includes a suction cup device **840** which

includes at least one suction cup **842** and in the illustrated embodiment two suction cups **842** and **844** arrayed in substantially the same plane for grasping a container having a surface to be grasped by both suction cups **842** and **844** in the same plane. Suction cup device **840** also includes a vacuum source **846**, a release valve **848** and a suitable vacuum line **850** which connects suction cups **842** and **844** to vacuum source **846**, as illustrated in **FIG. 30**, for example. In operation, when suction cups **842** and/or **844** engage a container or other member to be grasped, vacuum source **846** is activated to supply vacuum to suction cups **842** and **844**, such as to grasp and retain a container from one of apertures **720**, **722**, **724** and **726** of container storage magazine **638**.

[0273] Linkage assembly **780** includes, in the illustrated embodiment, a first link **852**, a second link **854** and third link **856**.

[0274] First link **852** is rigidly secure to axle **836** and pinion **774**. First link **852** is configured in an L-shape with the end of first link **852** opposite the portion connected to axle **836** pivotally connected to second link **854** having one end being pivotally connected to first link **852** via pivot connection **858**.

[0275] Second link **854** is connected to third link **856** via a universal joint connection **860** a location spaced apart from pivot connection **858** as illustrated in, for example, **FIGS. 30-37**. Section cups **842** and **844** are mounted to second link **854**. An offset member **862** which depends from second link **854** provides a desired offset for universal joint connection **860** which connects second link **854** to third link **856**.

[0276] Third link **856** is, in turn, connected to frame **776** via a universal joint connection **864** which is at a distance removed from universal joint connection **860** which connects third link **856** to second link **854**. An offset member assembly **866** is rigidly secured to frame **776** and includes an angled block **868** and an offset extension **870** to provide the desired angled and clearance for universal joint **864** and third link **856**.

[0277] In operation, when moveable rack member **772** is moved relative to mast **768**, such as when stop **834** contacts a surface, such as in the illustrated embodiment, countertop surface **636** as illustrated in **FIG. 36**, continued downward vertical movement of mast **768** causes rack member **772** to move upwardly relative to mast **768**. This causes rotation of pinion **774** which meshes with rack **824** mounted to rack member **772**. Rotation of pinion **774** in a counter-clockwise direction in **FIG. 30** causes rotation of first link **852**. Such rotation causes downward movement of that portion of first link **852** that is pivotally connected to second link **854** via pivot connection **858**. Such movement, in turn, causes second link **854** to pivot upwardly about pivot connection **858** in a clockwise direction as viewed in **FIG. 30** to cause suction cups **842** and **844** to move to a vertically oriented position as depicted in **FIGS. 34-37** from the horizontally oriented position depicted in **FIGS. 30-33**. In addition, such movement of first link **852** causes movement in rotation of third link **856** and universal joint connection **860** and **864** to the position indicated in **FIGS. 34-37**. When container grasping member **778** is in the position indicated in **FIGS. 34-37**, an unerected container held by suction cups **842** and/or **844** will be vertically oriented when suction cups **842** and/or **844** are attached to the container sidewall, as illustrated in **FIG. 40**, for example.

[0278] In a typical operation, container retrieving and grasping device **762** will be operated to position suction cups **842** and **844** below a container to be selected from container storage magazine **638**. Mast **768** will be raised by operation of vertical translation mechanism **790** to a desired height so that suction cups **842** and **844** engage a container contained at the bottom of container storage magazine **638**. Vacuum source **846** is activated and mast **768** can be lowered to remove a container from a desired one of apertures **720**, **722**, **724** and **726** of container storage magazine **638**. Carriage system **770** can be activated to move container retrieving and grasping device **762** laterally to a desired location. Such lateral movement can be controlled by properly positioned sensors **872**, **874**, **876**, **878** and **880**, for example. For example, sensor **872** can define the position to retrieve a container from aperture **720**, sensor **876** to retrieve a container from aperture **722**, sensor **878** to retrieve a container from aperture **724** and sensor **880** to retrieve from aperture **726**. Sensor **874** can be positioned to define the proper location of container grasping member **778** to erect the container that has been retrieved from one of apertures **720**, **722**, **724** or **726** of container storage magazine **638**, as hereafter described. After erecting the container, the vacuum applied to suction cups **842** and **844** is released by operation of release valve **848** which permits suction cups **842** and **844** to disengage and release the container that had been grasped. Mast **768** can then be raised causing stop **834** to be removed from countertop surface **636** and by action of weight **826** and operationally spring **832**, causing rack member **772** to move downwardly relative to mast **768** thereby rotating pinion gear **774** clockwise relative to the position shown in **FIG. 34**, thereby moving linkage assembly **780** to cause movement of container grasping member **778** from the position illustrated in **FIGS. 34-37** to the position indicated in **FIGS. 30-33**, where container grasping member **778** is in position to retrieve a desired carton from container storage magazine **638** in a manner previously described, which includes lateral translation of container grasping member **778** by carriage system **770**.

[0279] It is to be understood that any suitable automated device or system for retrieving, grasping and moving a container to a desired location as desired herein can be utilized in accordance with various aspects of the present invention. Thus, various aspects of the present invention are not limited by the particular embodiment of container retrieving and grasping device **762** and components thereof described herein. For example, an automated or robotic arm could be utilized to select, grasp and retrieve erected or unerected containers from a source as desired and then erect the carton or container in a suitable manner, followed by holding the erected container at dispensing location **710** and after filling placing the filled container, such as container **611** on to a suitable conveyor to move the filled container to a desired location.

[0280] Container grasping device **764** of container retrieving and grasping device **762** will now be described, and in particular with reference to **FIGS. 38 and 40-44**.

[0281] Container grasping device **764** includes a rotatable and vertically translatable mast **884**. Mast **884** can be rotated as illustrated by arrow P in **FIG. 38** and vertically translated up and down as indicated by arrow O also in **FIG. 38**. Mast **884** is connected to a shaft **886** via a slot and key arrangement between mast **884** and shaft **886** permitting mast **884**

to be rotated by shaft **886** which, in turn, can be rotated by a step or motor **890** or other suitable motor or device to rotate shaft **886** a desired degree. Motor **890** drives a drive pulley or gear **892** which, in turn, drives a driven pulley or gear **894**. In the case where pulleys are utilized, a belt **896** is used to transmit rotation from pulley **892** to pulley **894**. Motor **890** can be a stepper router or a servo motor as desired. Alternatively, an AC or DC motor can be utilized provided that a suitable control is provided so that the orientation of mast **884** can be determined. A carriage system **898** is utilized to provide the desired vertical movement of mast **884** in up and down directions. Carriage system **898** is similar to carriage system **770** previously described and includes a carriage guide **900**, a worm gear **902**, a carriage follower **904**, a drive mechanism **906** which includes a motor **908** (which can be a servo motor or an AC or DC motor) suitably controlled to drive or gear **902**. Carriage follower **904** includes a threaded aperture or slot **910** which communicates with worm gear **902** and a threaded aperture or slot **912** in which guide **900** is disposed. A carriage follower interface **914** connects carriage follower **904** to mast **884** and permits shaft **886** to rotate with respect to carriage follower interface **914**. Thus, in operation, rotation of motor **908** rotates worm gear **902** thereby translating carriage follower **904** up or down depending on the direction of rotation. A suitable sensor (not shown) can be employed to determine the height of mast **884** for control by control system **118** for packaging device **600**.

[0282] Suitable mounting structure **916** is provided to mount container grasping device **764** to a desired location, such as within cabinet **602**. A slot and key arrangement between shaft **886** and mast **884** permits **884** mast to be vertically translated either up or down while shaft **886** is rotated.

[0283] Mounted on the upper end of mast **884** is a suction device **918** which includes a suction cup **920**, a source of vacuum (not shown) for suction cup **920** and a release valve (not shown) for releasing the vacuum to suction cup **920**. Vacuum can be supplied from within mast **884** to suction cup **920** by a suitable connection as is known in the art.

[0284] Container bottom urging device **766** consists of a mast **922** that is vertically translatable up and down by suitable apparatus (not shown). Such apparatus can be similar to vertical translation mechanism **790** previously described with respect to container retrieving and grasping device **762**. Preferably, mast **922** has a blunt end **924**.

[0285] In operation, container retrieving and grasping device **762** selects an appropriately sized container from container storage magazine **638** as directed by the control system for food packaging device **600**. After retrieving the container, which in this case is container **611**, container retrieving and grasping device **762** moves container **611** to a position as indicated in **FIG. 40** against suction cup **920** so that opposed sidewalls of container **611** are grasped by suction cups **840** and **842** of container grasping member **778**.

[0286] Next, as shown in **FIG. 41**, container grasping member **778** is moved laterally away from suction cup **920** while maintaining suction on suction cups **840, 842** and **920**. Container **611** is partially erected as shown in **FIG. 41** with bottom **611** b depending downwardly slightly. Container bottom urging device **766** is then activated as illustrated in **FIG. 42** to urge bottom **611** b of container **611** upwardly into the fully erected position. Container grasping member **778** is released and retracted from container **611** and returned to a horizontal up position to select another unerected container For erection.

[0287] Next, mast **884** is rotated approximately 90° by motor **890** to place container **611** in discharge position **710** of food dispensing chute mechanism **608**. Food dispensing chute mechanism **608** is then lowered to discharge French fries FF therefrom and into container **611**. Any French fries that are not received into container **611** are collected by overflow food collection member **613** which is then rotated clockwise in the direction of arrow X as shown in **FIG. 41** to recycle such French fries to upper chute **686** for subsequent delivery to another container. After the French fries are dispensed from food dispensing chute mechanism **608**, cylinder **700** is retracted placing food dispensing chute mechanism **608** in the upper position as shown in **FIG. 44**. Mast **884** can then be rotated back and forth slightly (e.g., such as 2° to 20°, for example) to simulate shaking to dislodge any loose French fries or dangling French fries in container **611** and any dislodged French fries will then fall into overflow food collection member **613** for subsequent recycling. Mast **884** can also be raised and lowered slightly and relatively quickly either before, during or after the angular rotation to further simulate shaking. Thereafter, mast **884** is rotated approximately 180° until container **611** is directly over container-receiving receptacle **612** as indicated by T in **FIG. 44**. Mast **884** is then lowered by operation of carriage system **898** until the bottom of container **611** rests in container-receiving receptacle **612**. Then, the vacuum supplied to suction cup **920** is released and suction cup **920** releases from container **611**. Mast **884** can then be rotated **900** so that it is in position to receive another container to be erected.

[0288] Container-receiving receptacle **612** is then transported via conveyor system **614** which will now be described in detail.

[0289] Conveyor system **614** and portions or elements thereof are illustrated in various figures including FIGS. **1, 25-29** and **45-50**.

[0290] Conveyor **614** includes, in the illustrated embodiment, raceway **620** which can be formed along the surface of countertop **636** or on some other surface as desired. Raceway **620** is preferably in the form of a continuous loop raceway and is defined by spaced apart guides **620***a* and **620***b* mounted to countertop **636** to guide receptacles **612**. Conveyor system **614** includes one or more and typically a plurality of container-receiving receptacles **612** which are illustrated in detail in **FIGS. 46-50**. Gate structure **634** of conveyor system **614** includes a first gate **926** and second gate **928**. First gate **926** is moveable and typically second gate **928** can be stationary as hereinafter described.

[0291] Conveyor system **614** also includes structure for causing movement of container-receiving receptacle **612**. In the illustrated embodiment, container-receiving receptacles **612** are moved via an endless loop **930** that can be located beneath countertop **636**. Endless loop **930** carries a plurality of magnets **932** as illustrated in **FIGS. 45 and 49**, for example. Magnets **932** are spaced along endless loop **930**. Endless loop **930** may comprise a chain or other suitable structure that can be driven by a drive system that includes sprockets **934, 936, 938** and **940**. One of sprockets **934, 936, 938** and **940** can be a driven sprocket.

[0292] Any suitable endless loop **930** can be utilized such as a belt or a chain. Pulleys could be used in place of sprockets **934-940**. The route of endless loop **930** follows the route of raceway **620**.

[0293] Container-receiving receptacle **612** typically includes a base **942** and a container-receiving well **944** located over base **942**. Base **942** includes an enclosed compartment **946** which can be conveniently accessed by a base plate **948** located along the bottom of base **942** that is fastened to base **942** by suitable fasteners **950**. Contained within enclosed compartment **946** is a magnet **952**.

[0294] Container-receiving receptacle **612** follows the movement of magnet **932** due to magnetic attraction between magnets **932** and **952** thereby causing movement of container-receiving receptacle **612** along raceway **620**.

[0295] Enclosed compartment **946** is dimensioned to permit magnet **952** to be free to rotate therein allowing container-receiving receptacle **612** to be readily guided by rails **954** and **956** that are raised above countertop **636**.

[0296] Movable gate **926** prevents movement of container-receiving receptacle **612** located thereat as illustrated in **FIG. 45**. This ensures that container-receiving receptacle **612** is in position to receive a loaded container of French fries, such as container **611** from container grasping device **764**. After a filled container is placed on container-receiving receptacle **612** adjacent moveable gate **926**, gate **926** is automatically removed by a suitable mechanism (not shown) to permit container-receiving receptacle **612** thereat to be moved by conveyor system **614** until French fry container **611** contained therein contacts gate **928** or receptacle **612** contacts another receptacle that is located at pick up area **622** as shown in **FIG. 45**. Once container **611** is moved from receptacle **612***b*, receptacle **612***b* is then free to move along raceway **620** and passes underneath second gate **928**, which can be a stationary gate. Alternatively, second gate **928** could be a moveable gate and could be located at a level that directly prevents movement of receptacle **612***b*. After receptacle **612***b* passes underneath second gate **928**, receptacle **612***a* is moved into the position formerly occupied by receptacle **612***b* provided that receptacle **612***a* has a French fry container thereon which would then cause receptacle **612***a* to be stopped at gate **928**. Similarly, when that container is removed from receptacle **612***a*, receptacle **612***a* would then be free to pass underneath gate **928** and around that portion of raceway **620** until encountering gate **926** or another receptacle that is stopped by gate **926**.

[0297] Referring to **FIGS. 51-60**, there is illustrated various views of French fry cartons that are useful in accordance with the present invention. The French fry cartons depicted in **FIGS. 51-60** are particularly suitable for use in conjunction with the present invention since the cartons readily stand upright without assistance and can be erected by automated container handling system **610**, previously described.

[0298] **FIG. 51** illustrates a front elevation view of a carton **1012** that is particularly suitable for containing French fries, for example. Carton **1012** is illustrated in **FIG. 51** in an erected or opened position and includes a pair of opposed curved sidewalls **1014** and **1016** and a bottom panel **1018**.

[0299] Carton **1012** can be stacked in a collapsed configuration and stored in a suitable magazine, such as container storage magazine **638** as previously described. When in a collapsed position, carton **1012** is particularly suited to being opened or erected by pulling sidewalls **1014** and **1016** apart and urging bottom panel **1018** upwardly, as described with respect to the erection or opening of container **611** by automated container handling system **610**. Container or carton **611** is of a design that is similar to carton **1012**.

[0300] Carton **1012** also includes two supporting legs **1020, 1022** that extend downwardly from the lower portions of the overlapping edge portions of sidewall **1014** indicated by reference numerals **1014***a* and **1014***b* in **FIG. 59** and **FIG. 53**.

[0301] Carton **1012** is capable of standing on its own because of legs **1020** and **1022** that extend below bottom panel **1018** when carton **1012** is open or erected.

[0302] Carton **1012** can be constructed from a single blank of paperboard which is illustrated in **FIG. 59**. When constructed, sidewall edge portions **1014***a* and **1014***b* form flaps that are glued to the edges of sidewall **1016** as indicated in **FIG. 54**, for example.

[0303] Bottom panel **1018** is specially configured to facilitate opening or erection of carton **1012** by an automated carton handling device such as automated container handling system **610**, previously described in detail. Bottom panel **1018** includes intersecting lines **1024** and **1026**. Intersecting lines **1024** and **1026** intersect at a generally central location of bottom panel **1014**, which panel is generally oval even though it may incorporate straight edges **1028** and **1030**, for example. Intersecting lines **1024** and **1026** may be fold lines, lines of weakening, score lines or even perforations. All such structures are referred to herein with respect to intersecting lines **1024** and **1026** of bottom panel **1018** only as "fold lines." Typically, the intersection of fold lines **1024** and **1026** form an angle in the range of from about 60° and about 120°. In one embodiment, the intersecting bottom panel fold lines are oriented such that one of said lines (fold line **1024** in **FIG. 59**) is normal or at least generally normal to curved sidewalls **1014** and **1016**. In such embodiment, the other of the intersecting fold lines (in this case fold line **1026**) is at least generally parallel to curved sidewalls **1014** and **1016**.

[0304] Preferably, fold line **1024** extends from sidewall **1014** to sidewall **1016**.

[0305] As previously mentioned, carton **1012** is foldable to a collapsed position with sidewalls **1014** and **1016** being planar and in contacting overlying relation to each other with bottom panel **1018** being divided into two overlying panels **1018***a* and **1018***b* by intersecting fold line **1026**.

[0306] Preferably, bottom panel **1018** includes two additional fold lines **1032** and **1034** on either side of fold line **1024** that extends from one carton sidewall to the other, in this case from sidewall **1014** to sidewall **1016**. Secondary fold lines **1032** and **1034** further facilitate the opening or erection of container **1012** with an automated device such as automated container handling system **610**.

[0307] **FIG. 58** illustrates a carton **1036** that is similar in construction to carton **1012** previously described except that carton **1036** is of a different size. Preferably, carton **1012** is configured such that the width of the base is relatively narrow and the sidewalls **1014** and **1016** flare outwardly so

that container **1012** is substantially wider at the top (from about 1.6 to 2 or more times the base width) This allows relatively large and tall containers to be placed in an automobile cup holder CH as depicted in **FIG. 56**

[0308] Referring to **FIG. 2**, there is illustrated an alternate embodiment of an automated food processing system **101** in accordance with the invention Automated food processing system **101** includes a food dispensing device **201** which is similar to food dispensing **200**, previously briefly described, where like reference numerals represent like elements Food dispensing device **201** includes fewer uncooked bulk food dispensing containers **204** and additional magazine food dispensers that are similar to magazine food dispenser **206**, previously referred to Otherwise, dispensing device **201** is similar to dispensing device **200** previously described

[0309] Automated food processing system **101** also includes fry device **400** which has been described

[0310] One primary distinction between automated food processing system **100** and automated food processing system **101** is that automated food processing system **101** does not include an automated packaging device such as automated packaging device **600**. In place of food packaging device **600**, a food storage device **635** is provided Food storage device **635** allows food cooked by food frying device **400** to be stored in a heated environment for subsequent manual processing As configured in **FIG. 2**, food storage device **635** includes separate product receiving receptacles **637, 639, 641** and **643** Each receptacle **637, 639, 641** and **643** is dedicated to receiving food from a respective one of fry wheels **410, 412, 414** and **404**, respectively In addition, each receptacle **637-643** can have placed therein a suitable container to receive food, such as handled trays **645, 647, 649** and **651**

[0311] As illustrated in **FIG. 2**, a food item F is being discharged from fry wheel **414** down a chute **653** and into handled tray **649** contained within heated receptacle **641**. Food item F can be stored therein for a period of time until it is ready for subsequent processing

[0312] Referring to **FIGS. 62 and 63**, there is illustrated heated receptacle **643** in a cross-sectional view and **FIG. 63** is a cross-sectional view taken along line **63-63** of **FIG. 62** showing the entire width of receptacle **643**

[0313] As illustrated in **FIGS. 62 and 63**, heated receptacle **643** is a heated well having a heating element that heats sidewalls **962, 964, 966** and **968** as well as bottom **970** of heated receptacle **643** Heating element **960** is in close proximity to walls **962, 964, 966** and **968** as well as bottom **970**. Heating element **960** may be composed of a single heating element or multiple heating elements as desired. Suitable controls may be provided to adjust the temperature of walls **962-968** as well as bottom **970** of heated receptacle **643** In addition, suitable insulation **972** can be contained within the cavity that is defined by cabinet **974** of food storage device **635**, which is partially shown in **FIGS. 62 and 63**.

[0314] Preferably, handled trays **645-651**, such as handled tray **651** depicted in **FIGS. 62 and 63** are dimensioned such that they are in close proximity to walls **962-968** and bottom **970** when placed in heated receptacle **643**

[0315] Food packaging device **600** may optionally include food seasoning device **616**, which is illustrated in detail in **FIGS. 65-68** Food seasoning device **616** includes a hopper **972**, a metering wheel **974**, a wheel drive system **976**, a dispensing tube **978** and a dispersion head **618**

[0316] Hopper **972** is configured to hold a desired bulk quantity of a seasoning material, such as salt S Bulk hopper **972** includes a lid **982** that can be removed to replenish the supply of salt S contained therein. Hopper **972** can have a bottom with inwardly extending sidewalls **984** to facilitate the dispensing of material from bottom **986** of hopper **972** which may include a dispensing tube **988**.

[0317] Metering wheel **974** is located beneath bottom **986** and dispensing tube **988** to receive a charge of salt or other seasoning therefrom Metering wheel **974** includes a cavity **990** for receiving a charge of salt from dispensing tube **988**. Metering wheel **974** is rotatably mounted in a housing **992** and can be rotated about the longitudinal axis of metering wheel **974** to cause cavity **990** to be directed downwardly which thereby causes the seasoning or salt contained in cavity **990** to fall by gravity therefrom

[0318] Metering wheel **974** is suitably rotated by wheel drive system **976** Wheel drive system **976** can be controlled by a suitable electronic control system that can form part of the food packaging device **600** Typically, in operation, when French fries FF are dispensed from one or more of fry wheels **404, 410, 412** and **414** onto chute **604**, a suitable sensing device (not shown) senses the presence of French fries and activates wheel drive system **976** of automated food seasoning device **616** to discharge a predetermined quantity of seasoning, such as salt, onto the French fries that traverse chute **604**.

[0319] Dispensing head **618** can be located in a desired position to apply seasoning to the food traversing chute **604**. As illustrated in **FIG. 3**, for example, dispensing head **618** can be located towards a bottom portion of inlet chute **604** and may extend over a portion of rotatable food dispensing member **606**

[0320] Wheel drive system **976** as illustrated in **FIGS. 65-68** includes a solenoid plunger **994** for driving a linkage **996** that is connected to metering wheel **974** to impart rotation to metering wheel **974** Linkage **996** includes a crank arm **998**, one end of which is connected to a central portion of metering wheel **974** and the other end is connected to a lever arm **1000** which, in turn, is connected to solenoid plunger **994** Lever arm **1000** can be driven by solenoid plunger **994** which, in turn, causes crank arm **998** to be driven, thereby rotating metering wheel **974** sufficiently to cause cavity **990** to be directed downwardly, thereby permitting any seasoning or salt contained therein to be dispensed therefrom

[0321] A collection funnel **1002** is disposed at the discharge end of housing **992** and connects to dispensing tube **978** Dispensing tube **978** is, in turn, connected to dispensing head **618**

[0322] Dispensing head **618** can include a plurality of vanes **1004** for facilitating dispersion of seasoning dispensed therefrom As illustrated, there are four vanes **1004** spaced 90° from each other

[0323] Dispensing tube **978** has a lower end portion **1006** that terminates some distance above dispensing cone **1008** of dispensing head **618** In one embodiment, lower end

portion **1006** of dispensing tube **978** may terminate approximately 0 25 inches from the tip of dispersion cone **1008**

[**0324**] Dispersion cone **1008** includes a plurality of holes **1010** that are arrayed through dispersion cone **1008** to facilitate the distribution of seasoning or salt In operation, as salt or seasoning is dispensed through lower end portion **1006** of dispensing tube **978**, the seasoning strikes the top portion of dispersion cone **1008** and is directed into four quadrants via vanes **1004** As the seasoning traverses the surface of dispersion cone **1008**, some of the seasoning falls through holes **1010** in dispersion cone **1008** Note that not all of holes **1010** are labeled, for purposes of clarity in the Figures Other salt or seasoning particles do not fall through holes **1010** but fall off the lower end of dispersion cone **1008** Still other seasoning particles bounce or are otherwise deflected off the top surface of dispersion cone **1008** and fall a lateral distance removed from dispersion cone **1008** In this manner, a good distribution of seasoning is achieved over a relatively large area

[**0325**] The Control System and Method

[**0326**] In one embodiment, the System Master Controller of a Server (PC), a router/hub, and a touch-screen monitor (user interface) The Master can utilize existing technology to integrate, to manage, to control, and to coordinate information flow of and through the various subsystems for overall system operation The network technology is fully compliant with the latest version of the industry's NAFEM Protocol

[**0327**] Control System Features

[**0328**] Referring to **FIGS. 69-73**, the primary functions of the Control System are to receive order information from the POS and to connect and coordinate all operating subsystem controllers with the Master Controller so that operational commands and functional information can be communicated and displayed The result is that all the dispensing, fry and packaging modules function as one integrated fried foods production system

[**0329**] In one embodiment, the Control System is event and demand driven That is, nothing happens unless a functional component or subsystem receives a command signal to initiate the action In a normal operation mode, the POS will provide virtually all of the system order demands These can take the form of a string of two-bit Order Events Typically this will be a quantity and an item (for example, 2 each regular size fries) The product description can consist of both the food item and its portion size, treated as one bit of information

[**0330**] The Control System information can be categorized into Order Events, Inbound Events, and Outbound Events The Order Events come from primarily the POS system, the historical kitchen management system (KMS) data, or the touch-screen Monitor if a manager wants to override the automatic ordering KMS is a database of information of, for example, the sales rate of various products versus day and time The Order Events dictate and demand the operation and performance of the automation control system for production The Inbound Events information includes messages generated by subsystem controllers other than the POS or KMS The Outbound Events include typical command messages issued by the Master Controller specifying functions to be performed by individual subsystem controllers

[**0331**] In one embodiment, the Master Controller is configured to monitor periodically or continuously the network for events to occur Once an event takes place and a signal is sent on the network, the Master Controller identifies the source of the signal, then compares it to the programmed schedule of events within its memory, and reacts appropriately, either sending out a new command, showing a display, storing information in memory, or all of the above

[**0332**] An important source of data for the Control System can be the Kitchen Management System (KMS) The KMS is a historical database of operational information This information can be used to set the workstation configuration, process settings, inventory levels, and set a level of production in advance of actual customer demand orders This interface can be a two-way connection, so that all operational data from the Fried Foods Workstation can be received and stored in the KMS and/or the Control System, or evaluated, adjusted, and re-entered to "fine-tune" the process on a continuing basis

[**0333**] Generally, the Control System can comprise two loops, shown in **FIG. 70** The primary loop is the "Order-to-Package" loop, whereby the Master Control takes an Order Event input from the POS and directs the appropriate Packaging Module subsystem to package and deliver an appropriate portion of product A secondary loop is the "Buffer Replacement" loop, where the Master Controller receives an Inbound Event signal from the Packaging Module that its buffer inventory of ready-to-package fried product is low and additional product must be dispensed and fried As currently specified, all products other than salted French fries typically can have a default buffer inventory of zero, meaning that an order for that (other) product will immediately initiate a full dispense-fry-package (if packaged by the System) production routine

[**0334**] In accordance with one aspect of this embodiment of the Control System, the Fryer Module vat operation is not directly controlled by the production demand cycle Each fry vat of the fry module will operate continuously and on a pre-set uniform operating cycle Frozen product is dropped into the fry module when additional inventory is called for The product is fried according to the pre-set cooking cycle and then is dumped into the Packaging (or Protein) Module receiving apron None of the cooking cycle is affected by order demands, or inventory conditions In one embodiment, the Control System can vary the time between incremental rotation and speed of rotation of fry wheel **410** to accommodate for varying conditions, such as the level of cooking oil in the fry vat The level of cooking oil can vary as a result of the amount of product that is being fried in a particular fry vat, since product present in the fry vat displaces cooking oil, thereby raising the level of cooking oil in the fry vat particularly since the product is held below the cooking oil surface during a cooking cycle Preferably, to ensure the workstation reliability and system uptime, extensive control redundancy can be provided As a result, the control subsystems for each Fryer Module vat and each Dispensing Module chute are designed and constructed as individual units that operate even if one or more subsystem fails

[**0335**] Additionally, the control of the Dispensing Module freezer environment and operation can be an independent subsystem

[**0336**] Preferably, the Control System includes the capability to operate all modules individually This allows the

operator to disconnect and remove a module from the network and operate the remaining modules in a semi-automatic method, manually performing some of the operations Preferably, there are controls on each module that permit an operator to operate that module's functions locally

[0337] Orders for product are preferably processed sequentially as they are received, although the specific products within a customer order may be arranged in a logical manner as desired The Monitor will display all products being processed by the workstation from the time the order is received until it is removed from the workstation. The status of each product that is ordered can be tracked in its various stages including, for example, on order, packaged and ready to pick up, ready to manually package, and held too long

[0338] Preferably, products in the process of being fried can also be tracked, and cooking times for each basket in each wheel will count down to when product is ready to package.

[0339] Master Controller

[0340] In one embodiment, the Master Controller **110** hardware may suitably comprise, or equivalent:

[0341] Intel Pentium III (or higher) with 1 0 GHz (or higher) CPU

[0342] Ethernet network interface and hub

[0343] 256 MB (or more) system RAM

[0344] 20 GB (or more) hard disk drive

[0345] Touch-Screen Monitor Interface

[0346] Plug and Play Touch-Screen Monitor

[0347] SCK Gateway (Ethernet)

[0348] Interconnect cabling (as needed)

[0349] Optional Keyboard and pointing device (mouse) for installation and maintenance purposes

[0350] Typical operating system software requirements are:

[0351] Windows 2000 professional (or server) SP4 or higher

[0352] A suitable Database Server, such as Fast SCK Version 3 0 (or higher) from Fast, Inc of Stratford, Conn

[0353] Fast SCK Version 3 0 (or higher) Utility Applications (SCK Editor, SCK Engine, SCK Events, and SCK Site Editor) from Fast, Inc

[0354] The Subsystem Interface Modules provide the functionality to communicate specific control events (information) conditions, and/or commands to and from the Master Controller These modules typically can be incorporated into the circuitry of controller boards In cases where the network needs to interface with a control subsystem (such as PLCs, for example), appropriate imbedded memory interface (input-output) circuit cards known in the art can be utilized All of the foregoing hardware and software or equivalent is readily available or can be produced by those skilled in the art

[0355] Fryer Controller

[0356] The frying of the frozen product is controlled by a combination of cooking oil temperature and the time the frozen product is immersed in the cooking oil Frying is accomplished by moving the frozen product through the heated cooking oil by a rotating fry wheel As previously described, a programmable stepper or other motor can provide the desired precisely controlled movement of the fry wheel

[0357] The following Table I lists typical control parameters and several optional parameters that can be used, if desired

TABLE I

Fryer Module Control Signals
(One set for each of 4 Product Lanes)

Description	Input	Output	Op Adj
Set Temperature	X		X
Actual Temperature		X	
"Ready" Band Width		X	
Temperature Offset	X		
C or F	X		X
Probe #1	X		
Heater Relay #1		X	
Total Cook Time	X		X
Jog Speed	X		
Jiggle Time	X		
Cleaner Level		X	
Oil Fill		X	
Cleaner Fill		X	
Probe #2	X		
Heater Relay #2		X	
Flex Time	X		

[0358] **FIG. 71** depicts a typical motor/fry wheel/basket cycle Virtually every parameter can be fixed or adjustable as desired For example, during one typical cycle, which may be for a preset period of time that is one-quarter of the cooking time for food contained in a compartment, fry wheel **410** is rotated clockwise 45° in the direction of arrow K of **FIG. 13** After some period of time after the 45° incremental rotation, a basket shaking simulation of back and forth rotation occurs over a period of about two seconds After a 0 to 10 second delay, another basket simulation shaking occurs Thereafter, a period of time ("Basket Load Window") is available for loading another compartment, such as compartment **436** with a charge of French fries or other food to be fried Thereafter, a "no load zone" or relatively short period of time towards the end of the cycle is set aside just prior to another 45° fry wheel **410** rotation in the direction of arrow K, which commences another cycle. During each cycle, three "home routines" can be employed, one after each rotation of fry wheel **410** to accurately locate fry wheel **410** so that it is properly positioned with the upper end of compartment bottom **508** of one of fry wheel **410** compartments adjacent discharge **498** and another of the compartments properly aligned to receive a charge of French fries or other food to be fried, such as from food dispensing device **200**

[0359] To ensure proper operation of the basket/fry wheel, including positioning the unit precisely for smooth loading and complete unloading, the basket/fry wheel position must be constantly synchronized To do this, a "homing" sensor

circuit can be utilized that resets the home position after every move of the wheel This sensor preferably is electromagnetic and is impervious to dirt and grease build up and has no moving parts although any suitable sensor can be used

[0360] Dispensing Controller

[0361] The Dispensing Module control system **114** separates functions by the product delivery lane they support In one embodiment, where there are four delivery lanes, there are four control subsystems Each subsystem controls a vibrating product conveyor, a portioning load cell, and a dump actuator Additionally, there are optional module configurations that affect the controls design If lanes **1**, **2**, and/or **3** are configured with bulk food hoppers, a product level sensor can be provided to alert operators to reload frozen product before the hopper is empty If each of lanes **2**, **3** and/or **4** are configured with an array of coil magazines for food items, the controls must sequentially switch power to each of the motors in the lane to maintain a constant flow of frozen product

[0362] Table II lists defined control signal parameters for each of the Dispensing Module Lane controllers:

TABLE II

Dispensing Control Signals
(One set for each of 4 Product Lanes)

Description	Input	Output
Load - Small Qty	X	
Load - Large Qty	X	
Load Coil A	X	
Load Coil B	X	
Load Coil C	X	
Load Coil D	X	
Load Coil E	X	
Ready to Dump		X
Vibrator Frequency	X	
Bulk Fill Level		X
Time Out		X
Overweight		X
Clean Out	X	

[0363] Freezer Controller

[0364] In addition to properly dispensing products into the Fryer Module, the dispensing device **200** control **114** must also maintain a proper frozen environment for all products To accomplish this, another controller subsystem can be provided Table III lists the applicable control signal parameters for the freezer subsystem A safety circuit interrupts all dispensing activity when the aisle door is opened

TABLE III

Freezer Control Signals

Description	Input	Output	Op Adj
Set Temperature	X		X
Actual Temperature		X	
Aisle Door Open		X	

[0365] The separation of the Dispensing Module controls into these five subsystems when there are five makes for a convenient mechanical arrangement in the base of the module, and allows for the required flexibility given the configuration options

[0366] In one embodiment, for manual operation, four "dispense" buttons are provided, one for each lane One button would cause the release of a pre-set portion of the frozen product for that lane The controls preferably should be located so the operator could by visual observation determine the appropriate Fryer basket to make sure the product dispenses into the proper basket

[0367] Packaging Controller

[0368] Packaging Controller **118** for the Packaging Module incorporates several event signal generators for the control-system to sense or read The main Packaging Module or device **600** elements are depicted in **FIGS. 25-29** In one embodiment, the Packaging Module or device control system includes two subsystems within the Packaging Module, the packaging subsystem and the heated food storage device **635** that can be used in place of packaging device **600**

[0369] The Packaging Subsystem

[0370] The packaging control subsystem initially interfaces with the Packaging Module PLC and sends packaging device **600** a signal to start the sequential operation of packaging one of an appropriately-sized portion of French fries The actions and reactions of all the electromechanical devices (e g , container handling system **610**, dispensing member **606**, overflow member **613**, load cell **702** and chute mechanism **608**) can be, if desired, sequenced and controlled by the local on-board controller (i e , PLC) and not Master Controller **110**

[0371] Once the automated arm **764** sets the filled package of fries on conveyor **614** and the receptacle load gate **926** opens to allow receptacle **612** to move to the pick up area, a signal will be sent back to Master Controller **110** indicating that the particular order of fries is ready for pick up Until that receptacle **612** moves to the return gate **928** (located at the operator right front of the Packaging Module) and the gate permits receptacle **612** to move therepast after receptacle **612** is empty, Master Controller **110** will believe (and display) that the order of fries is waiting to be picked up Preferably, the crew member will pick up fries from right to left to ensure that the order sequence is followed and that the oldest fries are served first

[0372] Because the number of receptacles **612** that can fit between gate **926** and return gate **928** typically is limited, Master Controller **110** intelligence preferably keeps track of how many orders of fries are in the pick up cue This allows audible/visual alerts to be triggered on the Monitor to remind the crew that orders have been waiting. Also, even if orders are picked out of sequence, the Master Controller will remember what was on an empty receptacle **612** and clear it when it passes return gate **928**

[0373] Preferably, the Master Controller is configured to remember the hold time of each packaged fry order If the order has not been picked up in time, the Monitor will alert the operator by audible/visual signal to "waste" that order

[0374] The Secondary Loop

[0375] The remainder of the Packaging Module or device **600** control **118** functions address the secondary loop,

"buffer inventory replacement" Preferably, there are two typical system requirements for the buffer inventory: (1) there must be a minimum amount of fries in member **606** or chute mechanism **608** to completely fill the next packaging order (that is, one portion of a given size); and (2) the buffer inventory is low and needs to be replenished

[0376] For the first requirement, if there is insufficient buffer inventory to fill the package, chute mechanism **608** is disabled and an error message alarm is sent This condition should not happen, but the control intelligence prevents packaging device **600** from under filling an order

[0377] During normal operations, the level of fries in the buffer inventory will drop to a level where an inventory replenishment order will be initiated In that event, Master Controller **110** can signal dispensing device **200** to start its fill sequence This process should typically start soon enough that the replacement product can be fried, salted, and added to the dispensing member **606** before the "out-of-product" condition is reached The KMS data can be integrated into the Master Control intelligence to help insure that there is replacement product in process before the actual need arises This capability minimizes order delivery-delays while also preventing the dispensing member **606** inventory growing beyond actual need

[0378] The dispensing member **606** inventory can be managed in a number of ways, as desired For example, any of the following can be utilized and implemented by one of ordinary skill in the art: (a) direct sensors; (b) a load cell that constantly weighs the buffer inventory; and (c) a dynamic empirical calculation

[0379] The dynamic empirical calculation embodiment uses the Master Controller to constantly calculate how much product has been added to dispensing member **606**, and subtract out the portion packaged, any bonus amount, waste, and a safety factor This empirical total will then be compared to pre-set "reload" levels The formula may also include how much product is in process In all cases, the buffer inventory level can be adjusted during the day to reflect actual sales levels

[0380] The controls system design for all other (i e, non-salted French fries) products is that the same control process would be used, but that the "buffer inventory" for those products would be defaulted to zero That is, an order for hash browns would immediately signal an "out-of-inventory" condition and launch an "inventory replacement" command to the dispensing device **200** Later, if the need arises, controller intelligence would allow the operator to utilize some buffer inventory for these products

[0381] Optionally, a provision can be made for unsalted French fries Unsalted French fries would be handled like the non-French fries products When an order for unsalted French fries is received, Master Controller **110** will signal the Packaging Module to move diverter bar **605** The next load of French fries coming from the Fryer Module will then be diverted to a portion of chute **604** of packaging device **600** for manual packaging The extra unsalted fries can be manually returned to chute **604**

[0382] An important feature of the automated system is to maintain product integrity One facet of that is to dispose of product that has exceeded its authorized holding time Master Controller **110** will remember when each load of French fries came out of fry device **400** The mechanical design of packaging device **600** assures a substantially "first in-first out" product movement How long the "oldest" fries have been in dispensing member **606** is tracked by Master Controller **110** or packaging device controller **118**, as desired Whenever the allowable holding time has been reached, Master Controller **110** will signal the Packaging Module subsystem Controller **118** to start the buffer waste cycle (or the packaging device Controller **118** can directly control this function) It is possible that some French fries in the buffer will not have reached their limit, but through control parameter refinement, this can be minimized Table IV lists the control signals for one embodiment of the packaging control subsystem:

TABLE IV

Packaging Control Signals

Description	Input	Output	Op Adj
Package #1	X		
Package #2	X		
Package #3	X		
Package #4	X		
Divert Fries	X		
Produce #5	X		
Produce #6	X		
Produce #7	X		
Produce #8	X		
Produce #9	X		
Dump Buffer	X		
Buffer Low		X	
Buffer Full		X	
Receptacle Loaded		X	
Receptacle Empty		X	
Time out - System 610		X	
Product #5-9 Picked		X	

[0383] Holding Controller

[0384] The other control subsystem is that dedicated to holding product at proper temperatures Generally, a standard temperature controller with timer channels to manage all holding functions can be utilized, as is known in the art

[0385] Table V lists the various control parameters for the holding control subsystem for food holding device **635**:

TABLE V

Holding Control Signals

Description	Input	Output	Op Adj
Buffer Temp Set	X		X
Buffer Temp Act		X	
Pick Up Temp Set	X		X
Pick Up Temp Act		X	
Apron Temp Set	X		X
Apron Temp Act		X	
Holding Temp Set	X		X
Holding Temp Act		X	
Holding Time #1 Start	X		
Holding Time #1 End	X		
Holding Time #2 Start	X		
Holding Time #1 End	X		

[0386] Touch-Screen Monitor

[0387] The Touch-Screen Monitor is the primary system user interface and can be considered part of the Master

Controller configuration The Monitor has four main functions: (1) display the status of fried foods orders; (2) allow the operator to manually control the system; (3) alert the operator to any needed manual intervention; and (4) allow the operator to reconfigure the workstation and/or change the individual operating parameters

[0388] The Monitor display can be configured as desired. Preferably, the main display menu is simple, uncluttered and only presents the basic information needed to track ongoing order status. A sample Monitor display layout is shown in FIG. 72

[0389] In the illustrated embodiment, products on order would appear as horizontal rows of the appropriate product (type and portion size) icon, reading from the left edge of the screen All products from a single POS customer order would appear on a single line As additional POS orders are entered, the screen would refresh, moving the older orders down a line Products on order, and not yet ready for pick up would appear as gold icons.

[0390] Across the bottom of the screen would appear the same number of locations as there are packaging device 600 receptacles 612 in the pick up zone As packages of fries are placed on receptacles 612 and the receptacles 612 travel within the pick up zone, the appropriate icon will disappear from the "on order" line and reappear as a green icon in the spot where its receptacle is When a package is removed from a receptacle and that receptacle passes return gate 928, the display icon will disappear from the screen

[0391] In one embodiment, should the "hold timer" for a packaged product expire before it is picked up, its green icon will change color (i.e , to red) and/or flash In another embodiment, an audible alarm can be provided as well, indicating clearly that this product should be wasted

[0392] Across the top of the screen is a line of control "buttons." There can be one for each product (again, type and portion size). The system is programmed so that touching the button on the screen will enter an order for one each of that product There is also a screen button at the upper right corner of the screen that enables the operator to change the screen display to the "Settings" screen

[0393] The "Settings" screen layout is depicted in FIG. 73 From this screen, the operator may now configure all the operating settings for the product to be run in each product lane. The individual settings may include dispensing load size(s). fry vat temperature, cooking cycle time, buffer inventory level, packaging device Module heater setting, and other settings as desired In this embodiment, all settings for a particular product are linked to that product The operator can merely scroll in each product lane and signify the product that will be run in it Master Controller 110 will then set all operating parameters for that product If it is necessary to check or adjust an individual control setting (such as cook time), the operator can scroll through the items in the "settings" box for that lane and product Then, using the "up" and "down" keys, readjust the setting and press the "enter" key to reset

[0394] If required, a secure "manager only screen" can be configured to allow someone to adjust and/or reset selected operating parameters Access to this screen and these settings would require some type of password to prevent any non-authorized store employee from changing basic system parameters

[0395] Operator alert messages or alarms (e g , bulk product low—refill now: "bridging/time out"—clear lane 2; etc) will appear as an "error message box" in the center of the screen, along with some type of audible alarm

[0396] While the invention has been described with respect to certain preferred embodiments, as will be appreciated by those skilled in the art, it is to be understood that the invention is capable of numerous changes, modifications and rearrangements and such changes, modifications and rearrangements are intended to be covered by the following claims

1. A device for the automated frying of foods comprising:

(a) a fry vat for containing and heating cooking oil;

(b) at least one fry wheel having at least a generally circular perimeter and a plurality of compartments, each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the wheel, which radial axis is disposed above the normal operating level of the frying oil in the fry vat;

(c) a drive mechanism for rotating the fry wheel;

(d) a sensing device for sensing the level of cooking oil in the fry vat;

(e) a control system for operating the drive mechanism to rotate the fry wheel in one direction to cause food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and out of the cooking oil for subsequent discharge of the food from the compartment, wherein the control system adjusts the speed of rotation based on the level of cooking oil in the fry vat

2. The device of claim 1 wherein the control system causes incremental rotation of the fry wheel and the control system adjusts the period of time between incremental rotation based on the level of cooking oil sensed in the fry vat

3. The device of claim 2 wherein the control system adjusts the period of time between incremental rotation based on the temperature of the cooking oil in the fry vat

4. An automated method of frying food comprising:

(a) placing food in a fry wheel compartment of a fry wheel having at least a generally circular perimeter and a plurality of compartments, each compartment having an opening towards the perimeter, the fry wheel mounted for rotational movement relative to the radial axis of the wheel which radial axis is disposed above the normal operating level of the frying oil in a fry vat having heated cooking oil therein;

(b) sensing the level of cooking oil in the fry vat;

(c) rotating the fry wheel in one direction to cause the food deposited into one of the compartments to travel through the cooking oil in the fry vat over a period of time to fry the food and to move the food out of the cooking oil for subsequent discharge of the food from the compartment, wherein the speed of said rotating is related to the level of cooking oil in the fry vat

5. The method of claim 4 wherein said rotating comprises incremental periodic rotating of the fry wheel and adjusting

the period of time between incremental periodic rotating based on the level of cooking oil sensed in the fry vat.

6. The method of claim 5 further comprising adjusting the period of time between incremental periodic rotation based on the temperature of the cooking oil in the fry vat.

7. The method of claim 6 wherein the wheel comprises a rim and said rotating comprises urging a rotating drive wheel against the rim to cause said rotating the fry wheel.

8. The method of claim 4 further comprising moving air having small cooking oil particles upwardly from the vicinity of the fry wheel through a hood structure containing a filter and collecting cooking oil collected by said filter.

9. The device of claim 1 wherein the periodic incremental rotation is based on 360 degrees divided by the number of compartments.

10. The device of claim 1 wherein the drive mechanism comprises a rotatable drive member for imparting rotational movement to said fry wheel by rotational contact with the periphery of the fry wheel.

11. The device of claim 10 further comprising an outlet slide disposed to receive food discharged from the fry wheel after frying in said vat.

12. The device of claim 11 wherein said control system causes a compartment of said wheel having food therein to be aligned with said outlet slide to permit the slide to receive food discharged from said compartment.

13. The device of claim 12 further comprising a flexible lip at a peripheral end of each of said fry wheel compartments for minimizing any gap between the outlet slide and each fry wheel compartment that is rotated into position adjacent the outlet slide for discharging food from that compartment and onto the outlet slide.

14. The device of claim 1 further comprising small perforations in each compartment to permit cooking oil to flow therethrough.

15. The device of claim 14 further comprising a curved baffle disposed in the fry vat which is disposed adjacent the axial periphery of the portion of the fry wheel that is disposed in the cooking oil for preventing food contained in one or more of the fry wheel compartments from falling out of the compartments, wherein said curved baffle is perforated to allow cooking oil to flow therethrough.

16. The device of claim 1 wherein the fry wheel comprises a rim, the drive member comprises a roller, and the drive member comprises means for urging the roller against the rim.

17. The device of claim 1 further comprising a hood structure located over said fry wheel.

18. The device of claim 17 wherein said hood structure comprises an air filter located at an air exit of said hood structure and a drip pan to collect cooking oil from the filter, the drip pan located below the filter.

19. The method of claim 5 wherein said incremental periodic incremental rotating is based on 360 degrees divided by the number of compartments.

20. The method of claim 4 further comprising aligning a compartment of said fry wheel with an outlet slide to permit the outlet slide to receive food discharged from said compartment.

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